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Security for Short Loans

The effect of a "general memorandum" issued by the Board of Public Utility Commissioners of New Jersey in regard to the practice of corporations in pledging bonds as collateral security for short-time loans appears to be that if bonds are legally usable as collateral security in this way, such use constitutes a formal "issue" under the statute and requires an authorization by the board. A borrower does not usually contemplate the possibility that his collateral may so depreciate in value as to endanger the lending bank's margin of security. Similarly he does not feel that the bank may call his loan at a time of depression when other sources of money are closed to him or when a forced sale of his collateral may yield too little to meet his debt. However, in such contingencies, remote as they look to public utility corporations, bonds deposited as collateral security for short-term loans might reach eventually the public market, where their "issue" under formal authorization by the regulating commission would be assumed. No company, of course, would want to have any question raised in regard to the legality of issue of its securities, and naturally no bank would want to have any doubt cast upon the subject, so that the issue raised by the New Jersey commission is important, not only in that State but in other sections of the country as well. The necessity for short-time loans may arise suddenly, as in the event of a catastrophe, and the machinery of the commission should not be allowed to hamper companies in the effort to secure funds to provide service. This possible difficulty could be overcome if all companies could secure sanction in advance for the issue of bonds and could then hold them in the treasury awaiting the emergency or need. Such a plan, however, has a flaw because regulating commissions exercising authority under the broad laws to which we are now accustomed cannot well approve securities until they know the purposes for which the proceeds are to be used. An alternative plan is for the companies to try to prevail on the banks to take their short-time notes without collateral security.

Industrial Research

About a decade ago the great advantage to be derived from bringing the scientist directly to the manufacturer's workshop, provided this could be done in the proper spirit, become evident, and the institution now well known as the industrial research laboratory has gradually become firmly established. There are those who still maintain, and no doubt correctly, that the world's greatest discoveries come from independent investigators working alone, often amid great hardship, driven on by the fire of their own enthusiasm and complete absorption in one idea. Be that as it may, the industrial laboratory has now to its credit some remarkable achievements, which would do honor to any university investigator. It is also worth noting that these achievements are due in great measure to that broad directorship over research work which, while not imposing irksome restrictions, guides it toward useful ends. The production of the drawn-wire tungsten filament and the nitrogen-filled tungsten lamp, recently described by Dr. Irving Langmuir before the American Institute of Electrical Engineers and by Mr. L. A. Hawkins before the New York Electrical Society, are two noteworthy achievements to the credit of the research department of an electrical manufacturing company. While such spectacular results bring great credit to industrial research in general and to this department in particular, it seems to be a fact nevertheless that such departments represent an excellent investment even when measured by the value of their day-to-day services of a minor character rendered to a great industrial organization. The competition of industrial laboratories is acting with a healthy stimulative effect on university laboratories in which alone was formerly conducted all scientific research work, although the two are in many respects non-competitive, at least in the sense that the objectives are usually dissimilar. Announcements of university bequests to be devoted to research are made with more frequency than formerly, and the ultimate consumer may well congratulate himself upon the distinguished efforts that are being made in his behalf.

Utilization of Low Hydraulic Head

The account in this issue of the hydro-electric development on the Auglaize River is worthy of comment by reason of the rather difficult conditions of the hydraulic development. The utilization of a low head in a flat country is always troublesome. In this particular case the plant is in the flood region of Ohio and the dam and headworks were actually washed away in the great floods of last spring after the plant had been running for a few months. The present dam raises the water sufficiently to produce a head of 26 ft., which is fairly high for that part of the country. The flowage of the stream will be increased by some of the government works now nearing completion, and conditions are expected to be such as to enable some 40 per cent of the station equipment to be utilized at all times, while for most of the year the 5000-kw equipment can be fully utilized. In the power house of this plant use has been made of vertical turbines, as is frequently advantageous in low-head working. The arrangement of these units is somewhat unusual in that the weight of the rotating part is carried not by a step bearing but by a bearing hung at the top, there

being merely guide bearings below. In some respects the arrangement is advantageous on account of the great ease with which the bearings can be inspected and cared for. They are lubricated by oil under pressure and cooled by water. From the general standpoint of economy it is rather striking to find in a country of cheap coal a low-head plant like this in successful operation. We may be reasonably sure that from the strictly commercial standpoint the plant promises success in spite of the low head, the variable flow and the competition of cheap fuel. The fact is that a hydraulic plant economically installed and operated for profit can at the present time actually hold its own under conditions which a few years ago would have been deemed prohibitive.

Electric Traction and Safety

Theorize as one may about the more remote causes lying back of the numerous recent railway disasters, it still remains unpleasantly plain that the true causes have not been removed effectively. The latest addition to the list of wrecks is alleged to have been due to a broken rail, a conclusion doubtless correct so far as it goes. When one pauses, however, to inquire into the things that lie behind broken rails, dangerous switches and rear-end collisions some facts appear which are often not taken into consideration. It is well known that there has been a tendency to use rails too hard to resist shocks adequately—rails deliberately hardened to increase the wearing properties to a point utterly condemned under oath by one of the great railmakers giving testimony after a disaster. Bad switches have had their share of responsibility, switches good enough for moderate speeds but unsuitable for the traffic to which they were subjected, and there has been, too, a wholesale disregard of signals so far as fact and fancy in the evidence have been disentangled. Dead engineers tell no tales, and in some instances it never will be known just what really did happen, but there are certain features which we believe are worth attention from the standpoint of the electrical engineer.

With an electric locomotive which has practically all its weight on the drivers and the minimum of reciprocating parts, we believe it is a well-demonstrated fact that the maximum tractive power is secured with the minimum of pounding and bending of the rails. A very heavy electric locomotive is as bad as any other in the matter of mere weight, but for equal drawbar pull it has the advantage in strains imposed upon the track. In other words, in drawing a given train at given speed a well-designed electric locomotive should increase the factor of safety in the rail and decrease the chance of breakage either from direct fault of the rail or from fault of the underlying roadbed. The power of acceleration in an electric locomotive, due to the very large torque instantly available, makes it easier to run slowly at hazardous spots without losing time than is true with the steam locomotives. This feeling does not insure in itself safe operation, but it makes safe operation easier. Electric operation lends itself very readily to an absolute block system in which no train can find motive power within an occupied section. Safety systems of this kind can be put into service on any electrified system when the necessity for them is made evident, as it has been in the last few months. These facts furnish good reasons for the more general use of electric traction on trunk lines. Sufficient carelessness, neglect and mental obtuseness can make any system of motive power dangerous, yet, on the other hand, the fewer adverse conditions there are to contend with the less the danger is likely to be.

A matter which deserves to be investigated is the adequacy for present-day operation of block-signal systems installed some years ago. As trains have become heavier and speeds have been increased the braking distance within which the train can be certainly stopped has correspondingly increased. There is less leeway in case of running by a signal than there used to be, and hence the degree of caution once adequate is no longer sufficient. This fact of itself points to the need of a system of traction which readily permits the automatic holding up of a train which runs by a signal whether the engineer sees the signal or not. Even if the engineer is reasonably watchful, he may not aways catch promptly the signal set against him, and if, as sometimes happens, he relies upon the fireman to look for signals, the latter from exposure to the glare of the furnace may be quite unable to see them in time. It may be practicable to apply an automatic stop system to steam locomotives; some engineers believe it can be done. It is, however, perfectly well known that an automatic stop system acting to cut off the supply of energy can be successfully used in the case of an electric train. The plainest considerations of caution point to the advantages of electric traction, and it is to be hoped that the terrific lesson of the year 1913 will not be wasted.

Testing Shunt Instrument Transformers

The introduction of instrument transformers has been of great aid to electrical testing, but it has also brought about a need for the careful testing of such transformers themselves, since otherwise large errors might creep in through defects in their calibration. An instrument transformer possesses both a ratio and a phase angle. In some cases only the ratio needs to be measured and taken into account, but in other cases the effect of phase distortion accompanying the use of the instrument may be considerable. The testing of instrument transformers calls for a relatively higher degree of precision than ordinary ammeter or voltmeter tests, so that they are frequently dismounted and sent to special laboratories for test. Not only is this an inconvenience, but it is often important that such transformers should be tested locally in place, with their own leads and accessories.

In the article on page 898 Mr. H. B. Brooks describes a simple and ingenious method of testing any new instrument transformer against a standard transformer of the same type when a source of polyphase currents, and particularly of two-phase currents, is available, as is ordinarily the case, and when a suitable alternating-current wattmeter is at hand. The method depends essentially on measuring small differences in opposed alternating secondary voltages and theoretically calls for a voltmeter of very low range.

but not too low resistance, to measure these residuals. The ordinary voltmeter is well known to be of little use at very low range, but by separately exciting the voltmeter—that is, by using a wattmeter of suitable range with a steady current in the series coils—it becomes converted into a low-range voltmeter for detecting fractions of a volt. The method is so simple and so easily applied that it deserves to be made widely known.

Railroad Coach Lighting

The extensive and carefully conducted tests on day-coach lighting made during the past summer under the auspices of the committee on illumination of the Association of Railway Electrical Engineers and reported at that association's recent convention confirm previous results of tests on the lighting of various interiors and afford a striking commentary on the inefficiency of certain very common methods of steam railway car lighting as compared to the efficiency of other methods which are better in appearance and more comfortable to the passengers. With test results reduced to an equal basis of 66.6 lumens per running foot of car, there was a difference between the systems tested ranging from 2.42 ft.-candles for the most efficient translucent reflector equipment down to 1.03 ft.-candles for the least efficient of the lamp equipments tested.

It is gratifying to know that the bare lamp which obtrudes itself so atrociously in the vision of passengers on many cars is next to the bottom of the list in efficiency. Since it is both inefficient and uncomfortable, railway managements can no longer have excuse for continuing its existence. The standard square diffusing shade regularly used in sleeping cars also makes a very poor showing with only 1.35 ft.-candles. This equipment has always afforded a striking example of lack of attention to illuminating engineering with consequent loss of money to the operating company and a loss of illumination for the use of the passengers in such cars. Clear prismatic reflectors head the list at 2.42 ft.-candles, with heavy density opal reflectors a close second at 2.14 ft.-candles. The latter, on account of their ease of cleaning when of proper design, should find extensive use in railway car lighting. As might be expected, the highest efficiency was always obtained with bowl-shaped reflectors open at the bottom. All attempts to close the bottom of such reflectors with diffusing bowls have been unsatisfactory on account of the decided loss of efficiency.

The tests show that there is no practical difference in the measured illumination obtained with the center-deck and side-deck systems of lighting. In the center-deck system the lamps are placed in a single line along the center of the car. In the side-deck system one row of lamps is placed over each row of seats. However, the center-deck system has important advantages in lower cost of lamp renewals and cleaning and the use of larger and more efficient lamps. To avoid bad shadow effects it is found that lamps must be spaced opposite every two pairs of seats with either system where direct lighting is employed. With indirect or semi-indirect lighting, which, of course, is applicable to only the center-deck system, the spacing can be every three seats. It is interesting to note that both these latter systems in the tests gave higher efficiency than did the bare lamp. Thus, the most comfortable system for the eye under these specific conditions consumes less electricity than the most uncomfortable system. With such authoritative results before them, American railway managements can no longer have an excuse for the continuance of the inefficient lighting arrangements that have been too common in the past. The facts of the matter are that details of car-lighting fixtures in the past have too frequently been determined in an offhand way with the minimum of consideration by some official of a railroad who is unaware of the great differences in comfort and efficiency with the different lamp and reflector equipments available. It is a condition similar to that formerly existing in other fields of illumination. Fortunately, adequate excuse for the continuation of such conditions is rapidly vanishing.

Short-Circuited Turns in Radio-Telegraph Circuits

The mathematical solution stating the reaction of overhanging turns of inductances in radio-frequency circuits which Mr. Louis Cohen describes on page 899 of this issue is interesting in that it affords a theoretical and conciliatory confirmation of some qualitative experimental observations which have at times appeared in contradiction. It has often been noted that the action of short-circuiting portions of coils carrying high-frequency energy would reduce the current flow for constancy of other conditions. This has generally been blamed upon a direct I^2R loss in the short-circuited turns, though a number of radio engineers seem to have recognized the presence of a marked reduction in current due to a detuning effect caused by reduction of effective inductance on account of reaction of current in the closed secondary. The author in effect covers both these points by considering the current present after short-circuiting the secondary, and again after retuning the system "as a whole." While his results have not been quantitatively confirmed by other investigators, and although he quotes none of his own experiments in this direction, the general deductions from his theory seem to agree with practice.

A point not considered is the change brought about by the introduction of a natural period, in either the main coil or its short-circuited portion, approximating the period of excitation. The reactions in the several possible cases offer a pretty problem, since the self-resonant frequencies must change with every alteration of self-induction or mutual induction in or between the several parts of the coils considered. Phenomena which at first blush appear very curious, but which a little consideration usually explains satisfactorily, often occur in measuring large inductances at very high frequencies, owing to the similar natural frequencies of the coils under observation. If a complete analysis of these cases were presented, it is conceivable that the conclusion therefrom would be useful in the design of coils for actual radio-signaling.

The News of the Week

Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.

November Meeting, A. I. E. E.

A meeting of the American Institute of Electrical Engineers will be held in the Engineering Societies Building, New York, Nov. 14, at 8:15 p. m. The general subject of the meeting will be "Electrical Equipment of Gasoline Automobiles." Three papers will be presented as follows: "Dynamo Electric Lighting for Motor Cars," by Mr. Alfred E. Waller, Bronxville, N. Y.; "Advantages of Clutch Type Generators and of Separate Starting and Lighting Units for Motor Cars," by Mr. Alexander Churchward, New York, and "Electrical Equipment of Gasoline Automobiles," by Mr. Frank Conrad, Pittsburgh. The members of the Society of Automobile Engineers have been invited to participate in the meeting.

Society for Electrical Development

The campaign committee of the Society for Electrical Development, of which Mr. W. E. Robertson, of Buffalo, N. Y., is chairman, has enlisted the services of the salesmen employed by a large number of its members. These men, with the consent and co-operation of their companies, will devote the greater part of their time during November, which will be known as "pioneer month," to securing members for the society. It is estimated that the efforts of about 1500 men will be in this way put forth in behalf of the society during November. The total amount of funds pledged to the society's work is approaching $150,000, and it is believed that through this effort the $200,000 required will be available in December. The society now has members in every state in the Union except Maine, Delaware and North Dakota. The total membership at present approximates 700. This number doubtless will be considerably increased as the result of the special campaign now in progress. The society has issued in pamphlet form the address on "Electrical Co-operation" read by Mr. James H. Collins before the Jovian Congress at New York City on Oct. 16. Mr. Collins, whose articles on business problems are familiar to readers of the *Saturday Evening Post*, has stated the advantages of membership in the society in a broad and convincing manner. A brief abstract of his address appeared on page 829 of our issue dated Oct. 25.

Utah Power & Light Case Still Undecided

No decision has yet been rendered by the United States Circuit Court of Appeals in the appeal from the decision of Judge J. A. Marshall of the United States District Court of Utah, in a test case charging the Utah Power & Light Company, of Salt Lake City, with trespass in constructing a flume and reservoir in the Cache National Forest in Utah. The company constructed a flume and reservoir on government land which in 1902 was withdrawn from entry. The company relies upon the act of Congress enacted in 1886 granting right-of-way over government lands and further contends that the State's right of eminent domain over public lands is superior to the federal government's interest as a proprietor. The government holds that the act of 1886 has been virtually repealed and that the Department of Agriculture is authorized to withdraw land from entry and forbid its use for water-power purposes. The United States District Court dismissed the bill of complaint against the company by the government, and the decision of the United States Circuit Court of Appeals at Denver, Col., is awaited with interest as the issue involves the rights of the national and of the state government over public lands, and fees estimated at from $1,000,000 to $2,000,000 during the next ten years are contingent upon the outcome. Very many similar instances in mountain and Pacific Coast states are awaiting determination.

National Conservation Congress to Meet at Washington

The fifth National Conservation Congress will be held at Washington, D. C., Nov. 18, 19 and 20. In the notices sent out it is intimated that in the next few months the fight for the protection of the country's forests and waterways will command the attention of the nation. Direct reference is made to the prospect of a series of fights in state legislatures, which crystallizes the suspicion that the question of state rights is to play an important part in the coming combat. The officials of the Conservation Congress are concerned over activities in the West in the interest of state ownership and control of the national forests and waterways. So great is the clamor in some circles that it is understood that the conservation interests realize the importance of definite steps to prevent the states from wresting the control of these resources from the federal government.

Electricity Used by Government to Build Huge Irrigation Project in Montana

The Sun River Valley in Montana is now entering upon an era of electrical development which is to hasten the completion of one of the government's huge irrigation projects.

Seventy miles of transmission line have been built, extending from the Rainbow Falls hydroelectric plant of the Great Falls Power Company on the Missouri River westerly through the entire length of the valley to the base of the mountains where the principal diversion dam is now under construction across Sun River. The electrical energy, transmitted at a voltage of 110,000, is stepped down at three transformer stations, from which it will be distributed to the principal features of the work. It is now being used at the Sun River diversion dam, operating pumps and air compressors, concrete mixers and derricks and in lighting the construction camp and the site of the work. The government is constructing a distribution transmission line along the Pishkun Reservoir and the Sun River Slope canals, a distance of 44 miles.

The contract for the excavation of the main canals and laterals has been awarded and the contracting company is having special shovels and drag-line scrapers designed and constructed for the work. All power machinery on the work will be actuated by electricity, including the air compressors on the tunnel work. It is believed that a con-

siderable reduction of cost and time will be accomplished.

The power company is bound by the contract to extend the present trunk transmission line 30 miles when required by the United States at right angles entirely across the project. This will make available at the outset electrical energy for each of the towns now on the project and the considerable number of new towns already projected along the three new lines of railway which are being constructed across the project, giving them cheap energy for manufacturing and allied uses. The Sun River project involves some of the largest features of construction work yet undertaken by the Reclamation Service.

Standardized Plugs and Receptacles

The committee on wiring of existing buildings of the Commercial Section of the National Electric Light Association, of which Mr. R. S. Hale, of Boston, is chairman, is soliciting engineering, manufacturing, insurance and commercial opinions on the feasibility of standardizing plugs and receptacles. Should standardization be desirable, the committee would like to know how many sizes should be standardized, what should be the limits of demarkation between the different sizes, what steps should be taken to make the standardization effective, and the best methods to follow in eliminating non-standard plugs and receptacles from all future wiring work.

New York Edison School Term Opens

With eighteen special speakers secured for the term, among them many well known educators and "specialists," all arrangements have been completed for the 1913-14 courses of the Commercial School of the New York Edison Company at the Edison Auditorium, which began on Oct. 27. Dr. Hugo Munsterberg, the Harvard psychologist, the Rev. John Haynes Holmes and Dr. C. P. Steinmetz appear on the list, as do also the names of Mr. Walter Dill Scott, director of psychology at Northwestern University; Dr. James J. Walsh, Mr. John H. Patterson, of Dayton; Dr. Henry C. Metcalf, Mr. E. St. Elmo Lewis, Dr. Lee Galloway, Dr. Woods Hutchinson, Dr. Luther Halsey Gulick, Messrs. T. C. Martin, C. A. S. Howlett, S. Roland Hall, H. A. Holmes, E. J. Mehren and A. L. Pelton. Seven different courses have been arranged this year by Mr. F. C. Henderschott, director of the school. Each course touches a different phase of work of a public service corporation, and each is composed of a series of from six to nine lectures with examinations. Four courses are arranged for first-year students and three for second-year students. All employees of the commercial department must attend the school.

Meetings of the Philadelphia Section, I. E. S.

On the evening of Oct. 17 the Philadelphia Section of the Illuminating Engineering Society held a joint meeting with the Photographic Society of Philadelphia at the Engineers' Club, following a dinner for the members and guests. A paper by Mr. F. M. Steadman, entitled "A Simple Unit Method for Measuring the Intrinsic Actinicity of Flames and Surfaces for the Practice of Photography," was presented by Prof. A. W. Goodspeed, following which Mr. William J. Serrell presented a report of the recent Pittsburgh convention. A bank of lamps used by photographers in taking pictures under artificial light was exhibited and was described by Mr. Calvert. The photographic lenses on exhibition were described by Mr. George H. Hulse.

The following program has been arranged by the society for the coming season:

On Nov. 30 there will be a joint meeting with ophthalmologists of Philadelphia at the College of Physicians and Surgeons. Dr. Edward A. Shumway will present a paper on "Some Effects of Artificial Light Upon the Eye." Dr. George S. Crampton will discuss "The Effect of Mercury-Arc Lamps Upon the Eye," and Prof. Arthur J. Rowland will discourse on "The Lighting of a Private Library."

On Dec. 8 a joint meeting with the Philadelphia Section of the American Institute of Electrical Engineers will be held at which the following papers will be presented: "Brightness Measurements Versus Illumination Measurements," by Dr. Herbert E. Ives; "Railway Car Lighting," by Mr. George H. Hulse, and "The Mercury Quartz-Tube Lamp," by Mr. Buckman.

On Jan. 6 Prof. C. E. Ferree will address the society on the "Deficiencies of the Method of Flicker for the Photometry of Lights of Different Colors."

On Feb. 7 a meeting will be held under the auspices of the Drexel Institute, and President C. O. Bond, of the Illuminating Engineering Society, will speak on "Light and How to Use It."

On Feb. 18, when a joint meeting will be held with the Franklin Institute, Dr. Herbert E. Ives will present a paper on "Artificial Daylight."

On March 20 Mr. F. D. Bartlett will present a paper on "Lighting and Signaling Systems of Subways," and Prof. James Barnes will discuss "The Sun—the Master Lamp."

On April 9 at a joint meeting with the Franklin Institute Past-president Preston S. Millar will address the meeting on "Recent Developments in the Art of Illumination."

On April 18 two papers will be presented: "The Structure of the Normal Eye and Its Ability to Protect Itself Against Ordinary Light," by Dr. Wendell Reber, and "Glassware for Illumination and Other Purposes," by Mr. James Gillinder.

The season's work will close with a mass meeting of all the engineering societies of Philadelphia and vicinity, to be held on May 15. Arrangements are being made for a special program in which is included an address by Dr. Charles P. Steinmetz on "The Relation of Engineers to the Progress of Civilization."

Census Records of the Electrical Industry in 1909

Statistics on the electrical industry in the United States for 1909 have been given out by the Census Bureau. The figures cover only strictly electrical products and do not include the manufactures of wood or iron poles, glass or porcelain insulators, bare iron or copper wire, or any electro-chemical or electro-metallurgical products. There were engaged in the manufacture of electrical machinery apparatus and supplies in the United States in 1909 a total of 1009 establishments, employing altogether 105,600 persons, of whom 102,950 were wage earners.

The total capital invested in the industry as restricted above was $267,844,432 and the value of the products for that year totaled $221,308,563. The industry is largely centralized in the States of New York, Pennsylvania, New Jersey Massachusetts, Illinois and Ohio, ranking in the order named. Of the states named, New Jersey made the greatest gain over figures for the year 1904, and Michigan, while ranking low in total number of persons employed and in value of products, showed the largest gain of any state over the figures for the last census. More than two-thirds of the total number of concerns engaged in the manufacture of electrical products in 1909 were incorporated and the value of the product turned out by the corporately owned part of the industry was 96.7 per cent of the total for that year.

There were 13,882 direct-current and 2909 alternating-current generators built in 1909, with an aggregate value of

$13,081,048 and an average rating of 84 kw. Transformers numbering 76,729 and valued at $8,801,019 were manufactured. The production of switchboards was valued at $5,971,804. A total horse-power of 2,733,418 and a value of $32,087,482 were represented in the 504,030 motors turned out during 1909.

Of the total number of motors given in the report, 388,854, with an aggregate rating of 4,817,140 hp, were installed in manufacturing establishments, showing the growth of electric drive in that single year. The number of primary batteries manufactured in 1909 was 34,333,531, valued at $5,312,595. Arc lamps to the number of 123,985 and with a total value of $1,706,959 were produced, the decrease in figures from 1899 representing the inroads of the incandescent lamp for street-lighting work. The production of incandescent lamps showed a valuation of $15,714,089 and a total number of 66,776,997, of which about one-fifth represented tungsten lamps. The insulated wire and cable manufactures in 1909 constituted the largest single item in the electrical manufacturing industry. The total value of the insulated wire and cable made in the United States during 1909 was $51,624,731, of which $40,250,572 was the value of the product of concerns in the industry proper and the remainder was made by companies engaged primarily in wire drawing or other industries. Only a small number of the producers of insulated wire and cable drew the wire which they insulated.

"Electrical Day" at Dallas, Tex.

Friday, Oct. 31, was designated as "Electrical Day" at the Texas State Fair being held at Dallas, and it was made the occasion for an elaborate Jovian celebration and parade. Special provisions were made to register all visiting electrical men and to provide them with badges and tickets to the fair. The feature of the day, it was announced, would be the electrical parade held in the evening. The first of the three divisions was scheduled to contain twenty handsomely decorated floats furnished by the electrical firms of Dallas. For the second division between twenty and thirty decorated automobiles were entered, while behind them came the employees of electrical organizations, more or less in uniform, and carrying insignia, transparencies, etc. To heighten the effect of the illumination features carried in the parade, Manager E. T. Moore of the Dallas Electric Light & Power Company arranged to have the ornamental tungsten lighting extinguished for the time being along the line of march. All of the electrical houses in the city showed much enthusiasm over this feature of Dallas "Electrical Day," and neither time nor money was spared to make the occasion a huge success and one that would not soon be forgotten by the participants.

Fast Long-Distance Run by Electric Automobile

Another fast run was credited to a Bailey electric roadster last week, when a car operated by Col. E. W. M. Bailey, of S. R. Bailey & Company, Boston, made the trip from Boston to New York at an average running speed of practically 22 miles per hour. The trip from Boston to Worcester, 41.3 miles, was completed in one hour and fifty-nine minutes. After stopping in Worcester an hour for lunch, during which time the car was on charge, the run was continued to Springfield, the distance of 53.6 miles being covered in two hours and thirty minutes. After a two-hour charge at Springfield, the car finished the 66.1-mile run to New Haven in two hours and forty-eight minutes, ending the day's run of 161 miles. The average speed for the day was greater than that which most gasoline cars would have made under the same conditions. On the second day Colonel Bailey covered the 78.4 miles between New Haven and New York in three hours and fifty-one minutes on a single battery charge. The total distance of 239.4 miles was negotiated in eleven hours and eight minutes actual running time. The car was equipped with an Edison battery.

Sea Trials of the "Jupiter"

As we go to press a report is received that the electrically propelled collier *Jupiter*, described in our issue of Aug. 3, 1912, has made a successful forty-eight-hour trial at sea, off Santa Barbara, Cal. Unofficially it is stated that the vessel maintained an average speed of 14.78 knots per hour, or more than three-quarters of a knot above her designed speed. The *Jupiter*, it will be remembered, is a 20,000-ton ship equipped with twin propellers directly connected to three-phase induction motors, supplied with energy by a turbo-generator.

Three colliers of similar displacement, the *Cyclops*, the *Neptune* and the *Jupiter*, were equipped respectively with reciprocating engines, geared turbines and electric propulsion in order to secure comparative tests on vessels of sea-going ability.

Railway Electrical Engineers at Chicago

The opening sessions of the sixth annual convention of the Association of Railway Electrical Engineers, which met in Chicago Oct. 21 to 24 inclusive, were reported in last week's issue of the *Electrical World*. An account of the later sessions follows.

Methods of Battery Charging

Wednesday's meeting was opened by Mr. J. R. Sloan, of the Pennsylvania Railroad, who read the report of the committee on methods of charging storage batteries. The report was an extensive one and discussed the advantages and disadvantages of several methods of charging batteries with straight-storage, head-end and axle-generator train-lighting systems. For the first-named system the committee recommended placing a fixed resistance in series with the battery and maintaining a constant potential across both battery and resistance during charging. An ampere-hour meter can be used to open a circuit-breaker when the charge is completed. A similar method of charging was also recommended with the head-end system. For axle-generator systems two schemes rank about equal in merit, according to the committee's report. The underlying principle in both methods is to supply constant current to the battery until the latter attains a definite voltage, after which the generator pressure is maintained constant. Curves were presented showing the performance of batteries when charged according to the recommended straight-storage method.

Discussion

In the discussion which followed Messrs. W. H. Keirn, of Philadelphia, Pa., and L. L. Newman, of Pittsburgh, Pa., reported that the method of straight-storage charging recommended by the committee is proving satisfactory in cases under their personal supervision. Considerable discussion ensued on the merits and disadvantages of series and multiple charging. Mr. J. L. Minick, Altoona, Pa., said that it is inherently wrong to charge the batteries of several cars in series, as each set of cells will usually be in a different condition of discharge. Mr. J. R. Sloan described a wiring lay-out used by the Pennsylvania Railroad for charging its batteries, by means of which the cells can be connected in multiple or in series. Mr. L. L. Newman stated that a multiple lay-out is cheaper than one of the series type, since the switchboard, resistance and generator equipment are all simpler. Mr. J. H. Davis, Baltimore, Md., said that series wiring is warranted only where the charging yards are laid out in a long line rather than in a mass. Other speakers expressed belief that series charging can

be employed to advantage if cars are grouped according to the condition of their batteries. The remainder of the discussion related to the design of ballast resistors used to limit charging current.

STANDARDS AND SPECIFICATIONS

Mr. E. W. Jansen, of the Illinois Central Railroad, next read the report of the committee on standards, which contained specifications for axle-generator axles, generator suspensions, battery boxes, axle pulleys, electric connectors, etc. The report of a sub-committee on lamp specifications was included. This section enumerated, as new developments in lamp manufacture which will change present methods of inspection and test, the coming use of "vaccum getters," the elimination of seasoning of tungsten filaments, and the introduction of an inert gas under pressure into the bulbs.

Mr. B. F. Fisher, of the Westinghouse Lamp Company, said that lamp specifications should be modified to allow for developments in lamp manufacture. Owing to the present tendency toward shortening the period of seasoning tungsten filaments, the lamps will, when first purchased, show a higher candle-power than normal, but after being burned a few hours this candle-power is reduced. The period of seasoning has been shortened in order that the lamps may be packed and shipped like carbon-filament lamps without danger of filament breakage. This practice has also reduced the price of lamps.

LAMP TESTING

A paper entitled "The Problems of Incandescent Lamp Testing," prepared jointly by Messrs. Preston S. Millar and L. J. Lewinsohn, was read by Mr. Millar and gave a detailed account of lamp-testing procedure. Methods which are present practice were analyzed and their advantages and disadvantages were brought out. The authors declared that proper tests tend toward economical operation. Charts were shown indicating that tungsten lamps comply with purchasers' specifications much better now than heretofore, so that it is no longer so necessary to inspect sample lots. It is difficult to obtain reliable deductions from forced tests when lamps are burned above normal efficiency. Because of the non-uniformity of tungsten lamps, a large number of samples should always be selected for test. In 1911 the average life of a tungsten lamp was 750 hours and the power consumption 1.13 watts per candle; now the average life is 2500 hours and the consumption about 1 watt per candle.

Mr. W. H. Rolinson, of the Westinghouse Lamp Company, expressed belief that too much stress has been laid on defects in the appearance of lamp filaments, for few of these faults really affect the lamps' performance. If perfect lamp filaments are demanded, Mr. Rolinson added, the development of an inexpensive lamp product will be hindered. While agreeing with Mr. Millar regarding the lack of uniformity in smaller tungsten lamps, the speaker said that the rating of larger units can be predetermined with considerable accuracy. He emphasized the need of employing qualified lamp testers if the results of tests are to be depended on.

Some discussion followed on the derivation of life correction factors which are used in estimating the normal life of lamps from forced tests. Mr. Fisher said that the Westinghouse Lamp Company uses the initial watts per candle as a basis for determining life correction factors. Mr. Miller added that the Electrical Testing Laboratories are conducting tests to discover whether these factors cannot properly be based on the average watts per candle.

WIRES AND CABLES

Mr. W. A. Del Mar, of the New York Central & Hudson River Railroad, chairman of the committee on wire specifications, followed with the report of that committee, which covers wires and cables for pressures up to 15,000 volts. Paragraphs on the chemical analysis of rubber, potential test requirements, explanation of terminology used and order forms for wires and cables were included in the report.

Mr. R. H. Rice, Chicago, told of the work of the American Electric Railway Association in compiling similar specifications.

The report of the committee on installation of wiring for electric lamps and motors in railway buildings was read by Mr. Joseph A. Andreucetti, of the Chicago & Northwestern Railroad. This report supplements that of last year and includes specifications for the electrical equipment of movable railroad bridges. It goes into detail regarding conduit, outlet, pull and junction boxes, conduit supports, cabinets and panel boards.

A general discussion ensued in which it was intimated that too many details which cannot always be predetermined were included in the report. Mr. A. S. Schulman, Chicago, suggested that the committee be instructed to confer with committees from the National Electrical Contractors' Association and the National Electric Light Association.

OUTSIDE CONSTRUCTION

Mr. W. H. Keirn read the report of the committee on outside construction and yard lighting. Concrete poles were proposed under certain conditions where the track lay-out is a permanent installation. Where tracks are re-located frequently wooden poles are recommended. Methods of preserving wooden poles, installing cross-arms, insulators and pins, tying wires, etc., were also discussed. The committee does not favor the painting of cross-arms, but it does recommend brush treatment where the arm joins the gain. Warning to the public, and especially to linemen, of the proximity of high-tension lines by labeling poles "Danger" was also recommended. The use of high-tension overhead distribution lines on yard circuits was discouraged and secondary distribution recommended. Methods of clamping wires to insulators were described. Underground systems for yards were encouraged, owing to the assurance of contiuity of service, elimination of danger, low cost in up-keep and non-interference from changes in track lay-out. Topics of construction of manholes and underground systems, together with a discussion of the advantages and disadvantages of different types of lamps for yard lighting, concluded the report.

DATA AND INFORMATION

Mr. C. R. Gilman, of the Chicago, Milwaukee & St. Paul Railroad, chairman of the committee on data and information and the question box, next read his report. The data supplied reveal the tendency among railroads to replace arc lamps with large tungsten units. This is a step toward increasing the efficiency and decreasing installation and maintenance expenses. For the twenty-two roads reporting, the total rating in alternating-current shop motors exceeds that of direct-current motors by 8877 hp. The increasing use of alternating-current motors is ascribed to their lower first cost, greater reliability, lower maintenance expense and greater flexibility. On the same roads there has been an increase in the number of electrically lighted cars and a corresponding decrease in those lighted by oil. One ball-bearing company reports 2500 generators now in use.

ILLUMINATION OF CARS

The relative merits of various reflecting and diffusing media with different spacings of units were discussed in the report of the committee on illumination, of which Mr. Lewis S. Billau is chairman. The experiments from which the committee derived its conclusions were conducted in passenger coaches furnished by the Lake Shore & Michigan Southern Railway. Center-deck and side-deck systems were investigated with a view to obtaining adequate illumi-

nation, pleasing effects, good efficiency and satisfactory distribution of light. Center-deck lighting was found to compare favorably with side-deck illumination. For direct lighting, units should not be spaced more than 6 ft. apart. The color of head-linings has no appreciable effect on the useful illumination produced by direct units. The illumination values obtained show the desirability of using lamps of higher lumen output.

Mr. Arthur J. Sweet, Milwaukee, Wis., who had charge of the tests, described the methods of conducting them. Head-linings should have a light color, he believes, in order to reduce the contrast with the lamps. Fifteen-watt lamps have been found inadequate for proper illumination, and Mr. Sweet believes 600-lumen lamps would be more satisfactory. He advises rating lamps in lumens rather than in watts.

Mr. J. L. Minick, of Altoona, Pa., believed that indirect lighting of railway cars would not be universally used until more efficient lamps or other sources of electrical energy were developed. As a rough estimate he said that semi-indirect lighting requires double the energy taken by a direct system and therefore demands facilities for increased battery capacity.

Mr. P. S. Millar pointed out a fallacy in many eye-fatigue experiments made with glare. He said that increased intensity cannot compensate for lack of diffusion in producing satisfactory illumination.

In judging car lighting from the artistic viewpoint, Mr. Sweet reported that the majority of officials on railroads are in favor of light-density opal reflectors. Inclosing reflectors and diffusing bowls having a satin finish were considered next in popularity.

Mr. J. R. Cravath, Chicago, Ill., favored center-deck lighting as involving less specular reflection. He spoke of the inefficiency of Pullman lighting and said that under present conditions direct lighting is the only practical system for car illumination. To assist in preventing eye strain, reflectors can, however, be used which completely cover the lamps.

Self-Propelled Units

A paper on "Gas-Electric Cars" was abstracted by Mr. L. C. Joseph, Jr., Schenectady, N. Y. The gas-engine rating should be about 20 per cent larger than the generator rating to allow for overloads, and the set should be operated at a definite speed. Some tabulated data given indicated what can be expected of different types of these self-propelled cars. Figures were also quoted on the cost of operation of gas-electric cars. The paper included a description of essential driving and control parts, with an account of motor performance.

Mr. J. E. Hilton, of the Frisco system, presented some convincing data on the economic operation of gas-electric cars made by the General Electric Company. An average cost of 18.5 cents per car-mile was given for operating and maintaining this railroad's seven cars over a period of six months. Some of these cars pulled trailers, climbed 2 per cent grades and traversed as much as 100,000 miles in six months.

Detailed information on the construction of the electric tractor used for pulling freight cars by the Pennsylvania Railroad was given by Mr. T. V. Buckwalter, Altoona, Pa. This tractor is equipped with an eighty-cell Edison battery, operates in either direction, and develops 24,000-lb. drawbar pull with an 85-volt, 900-r.p.m. motor. All four wheels exert tractive effort.

Mr. George W. Cravens, Chicago, chairman of the committee on shop practice, submitted his report in which electric arc-welding operations, individual motor drive and automatic control were discussed. The committee advocated the use of automatic control on machinery where practicable and favored standardizing the power supply. Discussion of this report related mainly to details of shop practice.

A standing committee consisting of three members was established which will compile specifications and information on standard practice to be published in loose-leaf form.

Election of Officers

At the executive session which concluded the convention, the majority expressed themselves in favor of holding the 1915 semi-annual meeting at San Francisco, but no action can be taken until the next annual meeting, which will be held at Atlantic City coincidently with the Master Car Builders' convention. The semi-annual meeting for 1914 will be held at Chicago.

Officers for the ensuing year were elected as follows: President, Mr. C. R. Gilman, Milwaukee, Wis.; first vice-president, Mr. H. C. Meloy, Cleveland, Ohio; second vice-president, Mr. E. W. Jansen, Chicago, Ill.; secretary-treasurer, Mr. Joseph A. Andreucetti, Chicago, Ill. Messrs. J. J. Hack, San Bernardino, Cal., and N. E. Lemmon, Chicago, Ill., were chosen as new members of the executive committee.

Mr. C. R. Gilman, president-elect of the Association of Railway Electrical Engineers, is a charter member of the association and one of its most active supporters. He is also a member of the Illuminating Engineering Society.

PRESIDENT-ELECT C. R. GILMAN

Mr. Gilman was first to advocate the change from 110 volts to 60 volts for train lighting and was also instrumental in bringing about many changes in fixtures. He began his career as a machinest in the East, serving time first as an apprentice and later as a full-fledged machinist. In 1889 Mr. Gilman went to Milwaukee, where he was shortly appointed assistant to the mechanical engineer of the Chicago, Milwaukee & St. Paul Railroad. Later he became interested in train lighting and devised a system for head-end operation. Mr. Gilman is still in the employ of the same road, now holding the title of chief electrician.

A number of entertainment features were provided during the convention for the women present. On Friday evening the annual banquet was served, at which over 400 members and guests were present. Messrs. D. J. Cartwright, Phillipsburg, N. J.; Bion J. Arnold, Chicago, and F. W. Walker, Chicago, made addresses. Mr. Arnold spoke on the education of the engineer and Mr. Walker referred to the important part which electrical engineers are playing in the improvement of railroad service.

The exhibition of train-lighting equipment shown in connection with the Railway Electrical Engineers' convention was much superior in both variety and extent to the displays made by the manufacturers in preceding years. Two large halls in the Hotel LaSalle were occupied by the exhibits, about forty manufacturers being represented.

Chicago Convention of Electric Vehicle Association

The fourth annual convention of the Electric Vehicle Association of America was held in the Hotel LaSalle, Chicago, on Oct. 27 and 28. Headquarters were established on the nineteenth floor of the hotel and the meetings were held on this floor. The rooms of the manufacturers and dealers were on the eighteenth floor and there were a number of exhibits. The attendance numbered 351, and the convention was snappy and energetic, characteristic of an aggressive and alert industry.

PRESIDENT WILLIAMS' ADDRESS

President Arthur Williams, of New York, called the opening session to order promptly and read his annual address. Pointing out the remarkable development of the association, he said that it had grown from twenty-nine to 428 members in three years. The membership includes thirty-four manufacturers of electric vehicles and sixty-one central-station companies. There are sections in New England and Chicago and local associations in New York and Philadelphia, while a movement is under way to establish a local section on the Pacific Coast, probably in San Francisco. Eventually the membership ought to include every central-station company in the United States and possibly every user of an electric vehicle. There are now thirty-seven manufacturers of "electrics" as against twenty a year ago. It is estimated that there are 37,000 electric vehicles in the United States. Mr. Williams gave other interesting statistics and commented at some length on the advancement and prospects of the electric vehicle. In relation to electrically operated fire apparatus, for instance, he pointed out that there is no delay in starting, as is often the case with gasoline-operated fire engines. This saving of time is of great importance. Mr. Williams referred to the operation of storage-battery street cars in New York City and said that these cars are a good advertisement of the heavy duty of which the electric storage battery is capable.

One important suggestion which the president made was that street congestion in large cities be relieved by the substitution of night trucking for day trucking. This change would mean an enormous increase in economic efficiency. The speaker alluded to the very great possibilities of such business and to the income electric-service companies might receive from it. In the larger cities alone if all trucking were done electrically at 2 cents per kw-hr. the annual income would be about $400,000,000. Mr. Williams also pointed out that if motor vehicles became the rule large farm areas now devoted to raising food for animals would be released and utilized for the raising of food for the human race. The president urged the standardization of starting connections and complimented the advertising committee upon the very gratifying results achieved by its campaign. He alluded to the importance of the garage problem and said that an important work of the future would be the preparation of guide-books for all parts of the United States showing the locations of electric-charging and repair stations for vehicles. The address contained a number of important and interesting points, not all of which are mentioned in this brief summary. It was referred to a committee consisting of Messrs. Hayden Eames, of Cleveland; E. E. Witherby, of Chicago, and W. P. Kennedy, of New York.

TENDENCY OF LEGISLATION

Mr. E. W. Curtis, Jr., of New York, reported for the legislative committee in the absence of Chairman P. D. Wagoner. The committee commented that during the last year an epidemic of more or less radical legislation seems to have broken out in various sections of the country, its general trend being to penalize automobiles unduly by taxation or limitations of various kinds. The committee urged uniform state legislation in relation to automobiles. The outlook, according to the report, is that future legislation will increase the rate of taxation for automobiles in general and will limit the weight of trucks used for business purposes.

OPERATING COSTS AND STANDARD FORMS FOR COST KEEPING

The committee on operating records reported through Chairman W. P. Kennedy, of New York. It presented a table made up to show the general average operating costs of electric vehicles of various sizes and also submitted a standard form for keeping the costs of operation of electric trucks. Mr. Kennedy exhibited a memorandum book designed for vehicle owners in which total cost figures may be entered. In estimating the cost of electrical energy in the table given no kilowatt-hour rate was mentioned, since conditions differ so greatly in different localities. However, Mr. Kennedy informed the association that the rate used was 4 cents per kw-hr. The cost of energy is only about 10 per cent of the total operating cost, so that the kilowatt-hour rate is not of the preponderating importance which it is often thought to be.

There was considerable discussion on this important report. Messrs. F. N. Carle of New York, Charles H. Marsh of Washington, J. A. Hunnewell of Lowell, E. S. Mansfield of Boston, W. H. Conant of Washington, Day Baker of Boston, C. F. Smith of Boston, George H. Jones of Chicago, J. S. Codman of Boston, S. G. Thompson of Newark, N. J., and others took part.

INSURANCE OF ELECTRIC VEHICLES

Mr. Day Baker, chairman of the committee on insurance, reported that during the year the committee had been successful in securing a 10 per cent differential rate on liability insurance in favor of electric vehicles as compared with other forms of motor cars. This rate has been almost universally adopted. Also, the committee has obtained from the New England Casualty Company a further consideration equivalent to practically a 20 per cent differential from the standard rates for gasoline-driven automobiles and trucks. President Williams and Mr. Converse D. Marsh, of New York, commented on the advertising and other values of this insurance differential in favor of the electric vehicle.

ELECTRIC-VEHICLE EDUCATIONAL WORK

Mr. Charles Blizard, of Philadelphia, in the absence of Chairman W. G. Pancoast, read the report of the committee on the establishment of courses of instruction. The work in the West Technical High School of Cleveland was described.

In the discussion Mr. E. M. Jackson, of Denver, told of the educational work in relation to electric vehicles undertaken by the Denver Gas & Electric Light Company. This subject, he said, is very important, and he suggested that a course of battery and vehicle instruction be conducted by the Electric Vehicle Association. Mr. E. E. Witherby, of Chicago, added that the association might undertake a correspondence school of this description intended for the practical benefit of young men engaged in the business. Mr. E. W. Curtis, Jr., of New York, said that the General Vehicle Company had established a school of that sort on its own initiative. Mr. Day Baker reported that some of the technical schools in Boston were taking up the subject. Mr. H. E. Niesz, of Chicago, described briefly the investigation undertaken by the Chicago Section, of which he is chairman.

PREVAILING RATES AND FACILITIES FOR CHARGING

Mr. John F. Gilchrist, of Chicago, as chairman of the committee, read the report on rates and charging stations. The report was based on data received from 128 electric-service companies, in answer to the committee's questions. The average rates reported in ninety-one of the largest cities of the country were 3.007 cents per kw-hr. for energy furnished to public garages and 5.338 cents for private garages. The committee described the battery-service sys-

tem, originated by the Hartford Electric Light Company, and expressed itself as genuinely interested to know what the final results of this plan would be. On this system the company buys, maintains, charges and installs in customers' trucks all batteries necessary for continuous operation. The customer is relieved from all care of batteries. The committee presented a large amount of data in the form of tables and curves.

Messrs. Harvey Robinson of New York City, L. L. Edgar of Boston, Homer E. Niesz of Chicago and Day Baker of Boston, in a short report on "What the Sections Are Doing," told of the work of the local electrical vehicle associations in their respective districts.

Co-operation of Manufacturers and Central Stations

Mr. E. L. Callahan, of H. M. Byllesby & Company, Chicago, summed up the advantages to be realized from promotion of the use of electric vehicles, as viewed by both the electric-vehicle manufacturer and the electric-service company. From the standpoint of the electric-vehicle manufacturer, said Mr. Callahan, the principal objects to be attained through co-operation are greater satisfaction among vehicle users, reduction of their operating difficulties, increased sales and advice concerning prospective purchasers. Through the co-operative effort the central station hopes to gain increased revenue from the sale of energy, use of off-peak energy, the advertising which is the result of the use of the vehicle, and the industrial and social progress of the community. The author declared that the rates of most progressive central stations are already quite fair for charging service. As the result of a recent study of rates in a city of 325,000 inhabitants, the vehicle-charging rate was set at 3.8 cents per kw-hr. for the first 1000 kw-hr., with a sliding scale reduction thereafter. Investigation has shown that the cost of charging electric vehicles is seldom even 10 per cent of the total cost of operation. Comparing electric irons and electric trucks as central-station revenue producers, Mr. Callahan declared that while the sale of a flatiron increases the company's annual gross revenue by about three times the price of the iron, the electric vehicle increases the revenue only about 6 per cent of its cost. The flatiron produces a revenue equal to its original selling price in about four and a half months, while the average electric truck requires approximately seventeen years and a pleasure vehicle twenty-five years to show the same return.

Discussion

A lively discussion ensued in which Messrs. C. D. Marsh, of New York City, and S. G. Thompson, of Newark, N. J., declared that central stations should share a large part of the expense of selling electric vehicles, as the revenue obtained from the vehicles is about 300 per cent of the cost of getting the business. Mr. Baker referred to a "Handbook of Electric Vehicles" which was written by Mr. F. W. Smith, of New York, and contains valuable information and data. Mr. H. H. Rice, of Indianapolis, pointed out that manufacturers should explain the possibilities of profit in the sale of electric vehicles to central stations if the latter's co-operation is desired. He added that the electric vehicle owes its greatest drawback to neglect in the garage rather than to its treatment on the streets.

Traffic Problems

An interesting paper on "Traffic Problems and the Automobile" was abstracted by the author, Dr. E. E. Pratt, manager of the Industrial Bureau of the Merchants' Association of New York. The speaker referred to legislation which has been enacted in New York against speeding and affecting street wear. The McAneny ordinance of New York was discussed and commended. This ordinance bases vehicle fees on the weight per inch of tire width, the weight per wheel, and on the width of car when this exceeds 6 ft. 6 in.

The Garage Problem

Opening Tuesday morning's session, Mr. E. S. Mansfield, Boston, presented the report of the garage committee, whose purpose is to investigate garage conditions and to attempt the arrangement of general local rates for the charging and care of electric vehicles throughout the country. The committee suggested that some provision be made whereby public garages can obtain repair parts for electric vehicles at a discount. The committee also reported the receipt of 100 official garage signs which will be distributed among garages qualifying for recognition. Reports from local garage committees were included in the general report.

Discount for repair parts furnished to public garages was the subject of the discussion which followed. Mr. C. K. Chapin, Memphis, Tenn., said that the Memphis Consolidated Gas & Electric Company has been operating a public garage without any agency agreement regarding discount on repair parts and at times has therefore been forced to do work at a loss. Nevertheless, there has been an increase of about 300 per cent in the number of passenger vehicles and about 700 per cent in the number of commercial cars in that city. Mr. Chapin believes that manufacturers should give public garages a discount on repair parts so as not to discourage the sale of electric vehicles, and added that agents in his locality would be glad to have the burden of repairs carried by the central station.

Electric Vehicles in Department-Store Service

Features of the garage equipment and vehicle installation of Gimbel Brothers' New York department store were described in Mr. David F. Tobias' paper on "The Electric Vehicle in Department-Store Service." An interesting practice of this store is the custom of rebuilding its vehicles each year instead of merely overhauling them. By maintaining a stock room in which repair parts are kept the time has been greatly reduced during which vehicles have to be "shopped" for repairs. Mr. Charles A. Duerr, manager of the garages of Gimbel Brothers, who contributed information for this paper, said that the Gimbel vehicles have operated at very small additional expense with snow on the ground, although gasoline cars have not done as well. Merchandise is transferred from the main store to the distributing stations at night with a considerable saving in time. Three years' experience with electric vehicles has demonstrated to Gimbel Brothers that such vehicles are a success.

A discussion followed in which Mr. C. F. Smith, Boston, quoted data showing that electric vehicles require, on the average, only one "tow-in" per 8500 miles of service with an average haul of 1.3 miles, while gasoline vehicles require one tow-in per 3000 miles of service with an average haul of 8 miles.

Care of Vehicle Batteries

Extracts from a report on vehicle batteries made to another association were read by Mr. S. C. Harris, of New York. Several electric-service companies have reported that there is no apparent reason why negative plates should not be used a second time, provided they have been properly cared for and are not too thin. But they should not be so used unless in such good condition that they will not limit the life of the second set of positives. The boosting of vehicle batteries should be resorted to more frequently, especially in winter.

Report on Publicity and Advertising

In his report Mr. F. W. Smith, chairman of the committee on publicity and advertising, declared that a campaign of such general educational character as the present one is not expected to produce many direct inquiries. There have been received, however, approximately 2000 communications as the result of this advertising. These inquiries were about evenly distributed between commercial and passenger cars, and they came literally from every corner

of the globe. In the spring work of 1913-1914 campaign it was early evident that the activities of the Society for Electrical Development would to some extent interfere with the collection of funds for the campaign of the Electric Vehicle Association. But, said Mr. Smith, with a few exceptions all of the larger central stations have renewed their subscriptions to the fund. At the time the committee report was written the total subscribers to the fund numbered 107, an increase of five over last year. There are eighty-two central stations contributing, an addition of one over last year. The battery and other accessory manufacturers number ten, or two more than last year, and the vehicle manufacturers fifteen, as against thirteen last year. There are, however, five within this class who have not subscribed to the second-year fund, making seven new names added to the list of vehicle manufacturers. The share contributed by each of the three classes stands as follows: Central-station companies, 54 per cent; battery and accessory manufacturers, 31 per cent; vehicle manufacturers, 15 per cent.

The second advertising campaign of the Electric Vehicle Association of America involves an expenditure of $33,422.28, and will be carried on through five advertising mediums, namely, general magazines, fashion and social magazines, central-station papers, automobile trade journals, and a fifth group contemplating the use of three special papers.

Aid for Purchasers of Trucks

Called on by President Williams, Mr. Hayden Eames, of Cleveland, Ohio, declared that the work of trucking might be done in the future by public-service delivery corporations. Mr. Eames then set forth briefly a plan originating in the fertile brain of Arthur Williams relating to the organization of an equipment trust to assist business men and corporations in the purchase of electric trucks. Manufacturers are often reluctant to take money from their businesses to improve their transportation facilities. The electric-vehicle equipment trust would advance the money, securing itself by liens on the equipment. A traffic-engineering bureau of the trust would see that the purchases were utilized to best advantage by the users. A similar plan is used with success in the purchase of railroad equipment, and Mr. Williams does not see why it would not work out in relation to electric commercial vehicles.

Other papers presented and discussed at the convention were: "The Merchant, the Central Station and the Electric Vehicle," by Mr. F. Nelson Carle; "Charging of Storage Batteries in Unattended Garages," by Mr. Maxwell Berry; "Electric-Vehicle Salesmanship," by Messrs. G. H. Kelly and E. J. Bartlett; "Recent Developments in Lead Batteries," by Mr. Bruce Ford; "Tires for Commercial Electric Vehicles," by Mr. F. E. Whitney, and "Organization," by Mr. Ralph Temple. Abstracts of these will appear in a later issue.

Election of Officers

President Williams had appointed as the nominating committee, Messrs. George H. Jones, of Chicago; E. W. Curtis, Jr., of New York; R. L. Lloyd, of Philadelphia; E. S. Mansfield, of Boston, and Charles Blizard, of Philadelphia.

On the report of the tellers the following officers were declared to be elected unanimously: President, Mr. Frank W. Smith, New York, United Electric Light & Power Company; vice-president, Mr. John F. Gilchrist, Chicago, Commonwealth Edison Company; secretary, Mr. Harvey Robinson, New York, New York Edison Company; treasurer, Mr. Day Baker, Boston, General Vehicle Company; incoming directors, Messrs. Arthur Williams, New York, New York Edison Company; W. P. Kennedy, New York; W. G. Bee, Orange, N. J., Edison Storage Battery Company; Clare N. Stannard, Denver, Denver Gas & Electric Light Company.

On taking office, President Smith spoke feelingly of the work of Past-presidents Blood and Williams. The thanks of the association were extended to President Williams by a rising vote. Just before adjournment, Vice-president Gilchrist was called upon for a few remarks. He paid a cordial tribute to the work of the vehicle manufacturer and said he thought that in the relation of manufacturers and central stations the latter had rather the better of the bargain. However, he hoped that a way could be found to make service wagons for central-station companies at lower first cost.

Mr. Frank W. Smith, who has just been elected president of the Electric Vehicle Association of America, is vice-president of the United Electric Light & Power Company of New York City, with which he has been continuously identified for a period of thirty-three years, having started as an office boy with its predecessor, the United States Illuminating Company in 1880. Mr. Smith was born in Alden, N. Y., June 22, 1867, and has been well schooled in the electric lighting business, especially in the administrative end. Starting at the bottom round, he has climbed from office boy to general clerk, to paymaster, to assistant auditor, to assistant secretary, then to secretary and finally to vice-president. Upon him has devolved the

PRESIDENT-ELECT F. W. SMITH

active management of the affairs of the United Electric Light & Power Company for a number of years. He is also a director of the company as well as of the Brush Electric Illuminating Company of New York. He has worked assiduously as chairman of the publicity and advertising committee of the Electric Vehicle Association of America in collecting funds for that work, and the success which has attended the society's campaign is due in large measure to his efforts. Mr. Smith belongs to the Engineers' Club, the Friars' Club, the American Institute of Electrical Engineers, the New York Electrical Society, the Municipal Art Society, the American Museum of Safety and the National Electric Light Association.

Entertainment and Registration

The convention was well planned by a large convention committee, of which Mr. H. E. Niesz was chairman, Mr. G. H. Atkins vice-chairman and Mr. W. J. McDowell secretary. Mr. L. E. Wagner was chairman of the sub-committee on entertainment. The total registration was 351, greater by 100 than last year. Philadelphia, through Mr. R. L. Lloyd, of the Philadelphia Electric Company, invited the association to hold its next year's convention in the City of Brotherly Love.

Chicago Electrolysis Ordinance May Be Modified

By a vote of twelve to four the local transportation committee of the Chicago City Council, after an animated all-day session on Oct. 25, approved a modification of the existing electrolysis ordinance to which the local traction companies have been so resolutely opposed. The ordinance, which was adopted by the City Council on July 15, 1912, provided that there shall be no drop in voltage between any two points on the electric-railway grounded return exceeding a maximum of 12 volts. Further, between any two points on the return 1000 ft. apart within a mile of the City Hall the drop shall not exceed the limit of 1 volt, and between any two points on the return 700 ft. apart outside of this mile limit the drop shall not exceed 1 volt. The maximum allowable drop before the passage of the 1912 ordinance was 25 volts between any two points within the city limits.

During the present merger negotiations the Board of Supervising Engineers, Chicago Traction, was asked to make a report on this subject. It reported that so far as it knew there is no place where the conditions imposed upon the companies using grounded return circuits are so severe as those imposed upon the Chicago electric-railway companies by the 1912 ordinance.

The National Bureau of Standards at Washington has also had an expert in Chicago recently to advise on the subject. As a result of the investigations by the representatives of the United States government, the city of Chicago and the Board of Supervising Engineers it was agreed that the necessary first cost for the initial investment required of the companies to comply with the 1912 ordinance would be $4,984,424, provided the ordinance was interpreted upon an average maximum load for a fifteen-minute period. Mr. Palmer, the city electrician, however, said that the net cost would be about $3,000,000, taking into consideration only the cost of apparatus not useful to the companies otherwise than for correction of electrolysis.

As a result of this situation the Board of Supervising Engineers, at the request of the Council, suggested a compromise plan which has recently been approved by a subcommittee of the local transportation committee of the Council. This plan, drawn up by Mr. Bion J. Arnold, chairman of the board, is substantially as follows:

The city is to be divided into three zones, and all uninsulated electric return circuits are to be so arranged that the sustained maximum difference of potential between any two points on any uninsulated portion of the circuit shall not exceed 10 volts in the inner or congested zone, 15 volts in the middle zone and 20 volts in the outer zone. The Board of Supervising Engineers is to have the power, however, to prescribe limits from time to time, notwithstanding the exact figures mentioned in the plan. This is to provide for the potential gradient. It also has the power to increase the allowable drop in the outer zone to 25 volts at such points as it may deem advisable for the extension of track in outlying districts of the city where the underground utilities are not fully developed. Within the period of two years the provisions of the ordinance must have been complied with by the companies throughout their entire railway systems. This is to be accomplished by the expenditure of not less than $1,000,000 as directed by the Board of Supervising Engineers, if, in its judgment, this expenditure is considered necessary. The companies shall expend further such additional amounts upon return circuits and other electrical apparatus as the Board of Supervising Engineers may from time to time prescribe in order to prevent damage from electrolysis.

The ordinance as passed by the committee must be passed by the City Council and approved by the Mayor to become law. If that is done, it would seem to be likely that similar action will be taken in the case of the elevated-railway companies and the Chicago Tunnel Company.

Regulations for New Jersey Utilities

At a hearing before the Board of Public Utility Commissioners of New Jersey in Trenton on Oct. 21 rules and regulations for electrical supply utilities and for all utilities owning or using poles and wires were adopted. Some changes have been made since the first copy of the rules was issued.

The third rule, as revised, will provide that construction work shall be in accordance with good standard practice, rather than in accordance with the recommended practice of associations. Each utility owning poles supporting wires on public highways is required on or before Jan. 1, 1915, to stencil each pole with identifying marks or numbers. Each pole, post, tower or other structure used for the support or attachment of wires, guys or lamps must be inspected by the utility with sufficient frequency to determine in each case the necessity for replacement or repairs.

The fluctuation in voltage on lighting circuits shall not vary between sunset and 11 p. m. for a period exceeding five minutes more than 3 per cent above or below the standard voltage, although causes beyond the control of the utility shall not constitute a violation.

Each utility supplying electrical energy for incandescent illumination shall inspect in a general way the incandescent lamps of each consumer to whom free renewals are supplied at least once every two years and render consumers reasonable assistance in securing incandescent lamps best adapted to the service rendered.

Each utility shall furnish to any prospective customer on request a statement of the kind or kinds of service available. Where unusual conditions prevail information shall be given as to the conditions under which efficient and satisfactory service may be secured.

Whenever any transformers, high-tension insulators or other appliances are removed from the system for any reason they must be inspected before being reinstalled.

A utility may refuse to connect with any customer's wiring when it is not in accordance with the provisions of the National Electrical Code, when the certificate of the underwriters or the local inspection bureau has not been issued, or when the wiring is defective under the rules of the utility. The rules contained in the 1913 edition of the National Electrical Code regarding grounding of secondaries are adopted for all new construction.

Utilities shall furnish customers supplied with energy on a measured basis with electric meters and such service appliances as are customarily furnished. Any utility now furnishing service through meters owned by customers must arrange to take them over by Jan. 1, 1914, and thereafter own and maintain all service meters. Detailed directions for the testing of watt-hour meters are given.

An electric meter may be considered correct when it does not show, in comparison with standards approved by the commission, an error greater than 4 per cent on the light load or heavy load. The normal load shall be considered as the following percentage of full connected load: (a) Residence and apartment lighting, 25 per cent; (b) elevator service, 40 per cent; (c) factories (individual drive), churches and offices, 45 per cent; (d) factories (shaft drive), theaters, clubs, entrances, hallways and general store lighting, 60 per cent; (e) saloons, restaurants, pumps, air compressors, ice machines and moving-picture theaters, 70 per cent; (f) sign and window lighting and blowers, 100 per cent.

Each utility supplying electricity shall equip itself with a rotating standard test meter of suitable range. It shall provide a house or switchboard type meter, or meters of suitable capacity to be used only for checking the rotating standards. This check should be made at least every week when the standard is in service. Utilities supplying direct current or having already other test apparatus, or small utilities having less than 100 meters, may apply to the commission for a modification of this rule.

A complete record is to be kept of all periodic tests and tests on old meters brought in. Each utility having more than 500 meters shall report monthly. Utilities having less than 500 meters shall report quarterly.

Public Service Commission News

INDIANA COMMISSION

The Valparaiso Lighting Company has filed with the Public Service Commission of Indiana a complaint against the city of Valparaiso and the Citizens' Mutual Light, Heat & Power Company of that city. The latter company is inoperative now but threatens to begin operations as soon as the City Council allows a franchise.

The case will test the section of the Indiana law which provides that the commission must issue a certificate of convenience and necessity before a competing utility plant may be installed. The complaint declares that notwithstanding the provisions of the commission act and notwithstanding there has not been secured from the commission a declaration that public convenience and necessity require a second public utility in Valparaiso, the city, through its Mayor and Common Council, has claimed the right to grant to the Citizens' Mutual Light, Heat & Power Company a franchise, and has in like manner claimed the right to enter into a contract with the Citizens' company for street lighting for a period of ten years.

The petitioner points out that it has been ready at all times to supply any or all electric energy needed either for private or municipal consumption.

The Public Service Commission has been asked to make physical valuations of electrical and other utility properties at Terre Haute and Vincennes.

MISSOURI COMMISSION

The Public Service Commission of Missouri has issued an order prescribing the form and governing the filing and publication of schedules of rates of electrical corporations and municipalities. The order provided that schedules should be filed not later than Oct. 15 showing rates for every kind of service in force on April 15, 1913, together with supplements covering changes authorized by the commission, if any, since that date.

The order states that full compliance will be expected from officials of corporations and municipalities in each instance. The commission defines the flat rate, the uniform meter rate, the demand rate, the two-charge rate, the three-charge rate, the block rate, the step rate and the consumer's output rate. It says that these methods of charge may be combined with various wholesale discounts, minimum guarantees, etc., but the fact that they are listed does not necessarily imply that they are in accord with the public service commission law, or that any or all of them have been or will be sanctioned by the commission.

A provision in a schedule that certain things may or may not be done according as the manager or some other official may direct is objectionable and will subject the schedule, when tendered for filing, to rejection.

MASSACHUSETTS COMMISSION

The Supreme Judicial Court has received an appeal signed by ex-Governor Morgan G. Bulkeley of Connecticut and others against the recent order of the Public Service Commission approving the issue of convertible debenture bonds by the New York, New Haven & Hartford Railroad to the amount of $67,552,000. One of the principal reasons for the appeal is that the company has a present indebtedness of $202,844,450, and it is contended that, since as a guarantor for obligations it is liable for the further sum of $79,648,900, the allowance by the commission of the issue is illegal. The appeal is taken to the court under Section 27, Chapter 784, Acts of 1913, by which the commission was established.

Current News Notes

WIRELESS BETWEEN AMERICA AND ASIA.—The first commercial message handled by wireless between America and Asia was transmitted Oct. 27 from the United States Army Signal Corps station at Nome, Alaska, to the Russian government station at Anadyr, Siberia.

* * *

MUNICIPAL PURCHASING AND TESTING DEPARTMENT FOR ONTARIO.—The Municipal Electric Association has approved the organization of a purchasing and testing department to be controlled by the Hydro-Electric Power Commission of Ontario for the purpose of supplying the various municipalities with necessary equipment at minimum rates.

* * *

DURHAM, N. C., TO ERECT LARGE ELECTRIC SIGN.—The Commercial Club of Durham, N. C., is hunting for a slogan or a short sentence to be displayed on a large electric sign which it proposes to erect in order to advertise the city. A prize of $50 in gold is offered for the slogan, the contest closing Nov. 5. Durham has a population of 27,000 and is a great tobacco center.

* * *

GROUNDING SECONDARIES IN WINNIPEG.—Public Utilities Commissioner Robson is making an investigation of the merits and demerits of the grounded secondary system of distribution, and has requested the Winnipeg Electric Railway Company and also the light and power department of the city of Winnipeg to show cause why they should not be compelled to adopt a grounded secondary system.

* * *

MISSOURI UTILITIES.—According to the Public Service Commission of Missouri, there are 109 municipally owned plants in that State furnishing water, gas, electricity and heat. The total number of companies engaged in the manufacture and distribution of gas, electricity, water and heat is 312. None furnishes all these commodities, but a number furnish two or more. The commission will soon begin the collection of information touching the rates of service furnished by these plants.

* * *

FLOATING POWER HOUSE AT JEFFERSONVILLE, IND.—The city officials of Jeffersonville, Ind., recently witnessed the test of a small installation of hydroelectric machinery carried on a barge moored in the Ohio River near that point. The floating power plant consisted of an endless chain of paddle-wheels which when lowered into the water was propelled by the current of the stream and drove a small generating unit. The apparatus used was of inconsiderable size and developed only a few horse-power. Experienced men who have studied the river in that vicinity for years are still skeptical, declaring that in certain seasons the current is insufficient to drive the paddle-wheels.

* * *

ELECTRIC SPANKER IN WEST VIRGINIA SCHOOLS.—Two schools of Huntington, W. Va., where the discipline has always been gaged by the strength of the instructor's arm, have been transformed by means of an electric spanker into institutions of learning with the best average deportment of all the schools in that city, according to Superintendent M. Foulke. A day or so after the school season began a carpenter and an electrician appeared at one of the schools and began the installation of a spanker in a small anteroom. The device delivers about five short sharp blows a second and worked so well in one school that it was installed in another. According to Superintendent Foulke, since the "persuaders" have been installed and their characteristics have become known, not one unruly pupil can be found in either school.

Machinery for Dredging Toronto Harbor to Be Operated Electrically.—All machinery to be used in deepening the Toronto Harbor will be operated by electricity. The Canadian Stewart Company, which has contracted to do the work for some $10,000,000, has asked the Toronto Electric Light Company, Ltd., and the Toronto Hydro-Electric System to quote prices for the supply of from 7000 hp to 8000 hp. On account of its simplicity, the contractors propose to substitute electricity for steam in the operation of dredges, pumps and other machinery. Work will commence next spring and three large dredges will be used. The smallest dredge will require 1250 hp and the work will extend over five years. The Toronto Hydro-Electric System obtained the contract for supplying the energy.

* * *

Analyses of Coals.—Bulletin 22 of the Bureau of Mines, entitled "Analyses of Coals in the United States," is a valuable contribution to the literature on coal. It contains descriptions of mine and field samples collected during a period of six years and has been compiled by Mr. N. W. Lord, with chapters by Messrs. J. A. Holmes, director of the Bureau of Mines; F. M. Stanton, A. C. Fieldner and Samuel Sanford. The volume contains information regarding the character of the coal, the impurities in the beds sampled and the nature of the roof and the floor of the beds, and gives supplementary details with reference to the output of the mine, the method of mining and preparing the coal and the chief uses to which the coal is put that may be of assistance to government engineers or purchasing agents and others in preparing specifications and awarding contracts for fuel. With about a thousand pages of reading matter, arranged geographically according to counties and cities, a bibliography, a list of Bureau of Mines publications on fuel technology and a most complete index that gives the names of places at or near which the samples described were collected, this comprehensive work will be found of much value to all interested in the subject. It has been issued by the Department of the Interior, Bureau of Mines, Washington, D. C.

* * *

SOCIETY MEETINGS

Meeting of the Industrial Electrical Engineering Society of Detroit.—At the meeting of the Industrial Electrical Engineering Society of Detroit at the Adcraft Club on Oct. 24, Mr. W. J. Fitzgerald, of the Detroit Edison Company, read a paper on "Electric Motors."

* * *

Meeting of Radio Engineers.—At a meeting of the Institute of Radio Engineers which will be held on the evening of Nov. 5 at Fayerweather Hall, Columbia University, New York, Dr. Lee De Forest will speak on "The Audion-Detector and Amplifier." Anyone interested in the subject is invited to attend.

* * *

New York Electrical Society.—Mr. L. A. Hawkins, of the research laboratory of the General Electric Company, delivered a lecture on "The Place of America in Scientific Research Work" before the New York Electrical Society on Oct. 23. The high-efficiency nitrogen-filled tungsten filament lamp was described and shown in use.

* * *

Meeting of Boston Edison Company Section, N. E. L. A.—The Boston Edison Company Section of the National Electric Light Association held its annual meeting on Oct. 21, the following officers being elected for 1913-14: President, Mr. J. W. Cowles; vice-presidents, Messrs. C. H. Crockett and C. E. Greenwood; secretary, Mr. J. J. Buckley; treasurer, Mr. C. H. Miles. Messrs. W. H. Cole and C. S. Hadaway were added to the executive committee. A paper by Mr. D. B. Rushmore, of the General Electric Company, was read describing the use of electricity in the construction of the Panama Canal and plans for its application in the permanent service of the great waterway. Mr. T. E. Pevard then gave a talk upon the new load-dispatching facilities of the Boston Edison system, which are to be completed within about two months.

* * *

Dinner of the Duquesne Light Company's Section, N. E. L. A.—The monthly dinner of the Duquesne Light Company's Section of the National Electric Light Association was held at the Colonial Annex Hotel, Pittsburgh, last week, more than 300 members attending. Mr. Henry W. Pennywitt, chief of the local weather bureau, explained the equipment and workings of the bureau, and motion pictures were shown of the last annual dinner of the section, held at Homestead Park last summer.

* * *

Electric Club of Chicago.—At a well-attended meeting of the Electric Club of Chicago on Oct. 23 Messrs. C. W. Forbrich, F. W. Harvey and F. P. Vose were appointed a committee to see if it be practicable to devise some modest death-benefit association as an auxiliary to the club. Mr. W. J. McDowell, secretary of the Chicago Section of the Electric Vehicle Association, invited the club to attend the Chicago convention of that association. Mr. D. J. Cartwright, of Phillipsburg, N. J., president of the Association of Railway Electrical Engineers, was present as the guest of the club and made a few remarks. The remainder of the meeting was devoted to home-talent entertainment. There were violin and flute solos by Messrs. W. S. Taussig and George C. Keech respectively and humorous speeches by Messrs. James H. Delany and Perry R. Boole.

* * *

Meeting of New York Companies' Section, N. E. L. A.—The first fall meeting of the New York Companies' Section of the National Electric Light Association was held at the Edison Auditorium Oct. 20. Mr. Joseph B. McCall, president of the N. E. L. A. and of the Philadelphia Electric Company, was present, and after a short address on association affairs conferred the Doherty Gold Medal upon Mr. T. F. Bludworth, of the New York Edison Company. This medal was awarded for the best paper presented before a company section during the year 1912 and was won on a paper entitled "Adaptability to Service." Mr. H. M. Edwards, chairman of the section, then introduced Mr. W. W. Freeman, recently appointed executive officer of the street railway, gas and electric light interests in Cincinnati, who told in an intensely interesting manner some of his experiences while on a recent trip through Mexico.

* * *

New Jupiter and Mercury Greeted with Enthusiasm.—The weekly luncheon of the St. Louis League of Electrical Interests, Jovian Chapter, on Oct. 22 was turned into a home-coming celebration in honor of the New Jupiter, Mr. W. N. Matthews, and the re-elected Mercury, Mr. Ell C. Bennett, both of St. Louis. The meeting was held in the City Club of St. Louis and 165 members attended. Messrs. Matthews and Bennett, who were elected to their positions in the Jovian Order in New York on Oct. 15, had a very cordial reception. Speeches were made by Messrs. Arthur H. Halloran, of San Francisco, managing editor of the *Journal of Electricity, Power and Gas*; A. C. Einstein, vice-president of the Union Electric Light & Power Company; H. J. Pettingill, president of the Southwestern Telegraph & Telephone Company; W. A. Layman, president of the Wagner Electric Manufacturing Company; Frank D. Beardslee, Union Electric Light & Power Company; Frank Adam, Mr. Matthews and others. The attendance was the largest recorded in the history of the league.

Hydroelectric Station on the Auglaize River

Low-head development in the flat lands of the Maumee River Valley in Ohio—Features of the generating and switching equipment

THE engineering possibilities of low-head hydraulic developments in an almost level country have again been demonstrated in the flat valley of the Maumee River in western Ohio by the construction on the Auglaize River, one of the Maumee's main tributaries, of the first hydroelectric station of the Auglaize Power Company. The city of Defiance, Ohio, 4 miles down stream, is the nearest railroad station to the development and was the point to which all of the material used in the erection of the plant had to be shipped. This lack of railroad facilities made the problem of transporting material no simple one, and some of the heavier pieces of machinery were hauled to the site of the station by means of a traction engine hitched to heavy wide-tired wagons.

STATE OF THE DEVELOPMENT

The present Auglaize development was begun in 1911 and was completed in 1912. Supplementing the station about to be described three more hydroelectric plants and one steam auxiliary station are now being planned. At the site of the power house and dam, as well as for many miles upstream, the river banks rise abruptly to an approximate height of 30 ft., affording an excellent natural basin for impounding water in the periods of maximum river flow.

About five months after the present station had been placed in operation the memorable floods of March, 1913, swept down upon the dam and headworks. At the period of greatest flow water 12 ft. deep was rushing over the spillway, while the difference in head caused by the 22-ft. dam in the river's path was but 2 ft. With this tremendous stream flow the water ran over the top of the river bank at the end of the dam farthest from the station, washing away the earth which backed up the retaining wall. This light concrete wall held for several hours, but when finally the supporting earth had been removed it crumbled before the torrent and gave the water a path around the end of the dam. The break did not noticeably affect the level of the river at Defiance, although with the news of the failure consternation spread among the city's inhabitants. The loss of both the impounded water and the natural stream flow during the time taken for repairs was, however, the cause of a considerable period of enforced idleness at the station.

The break has since been repaired and a cut is being

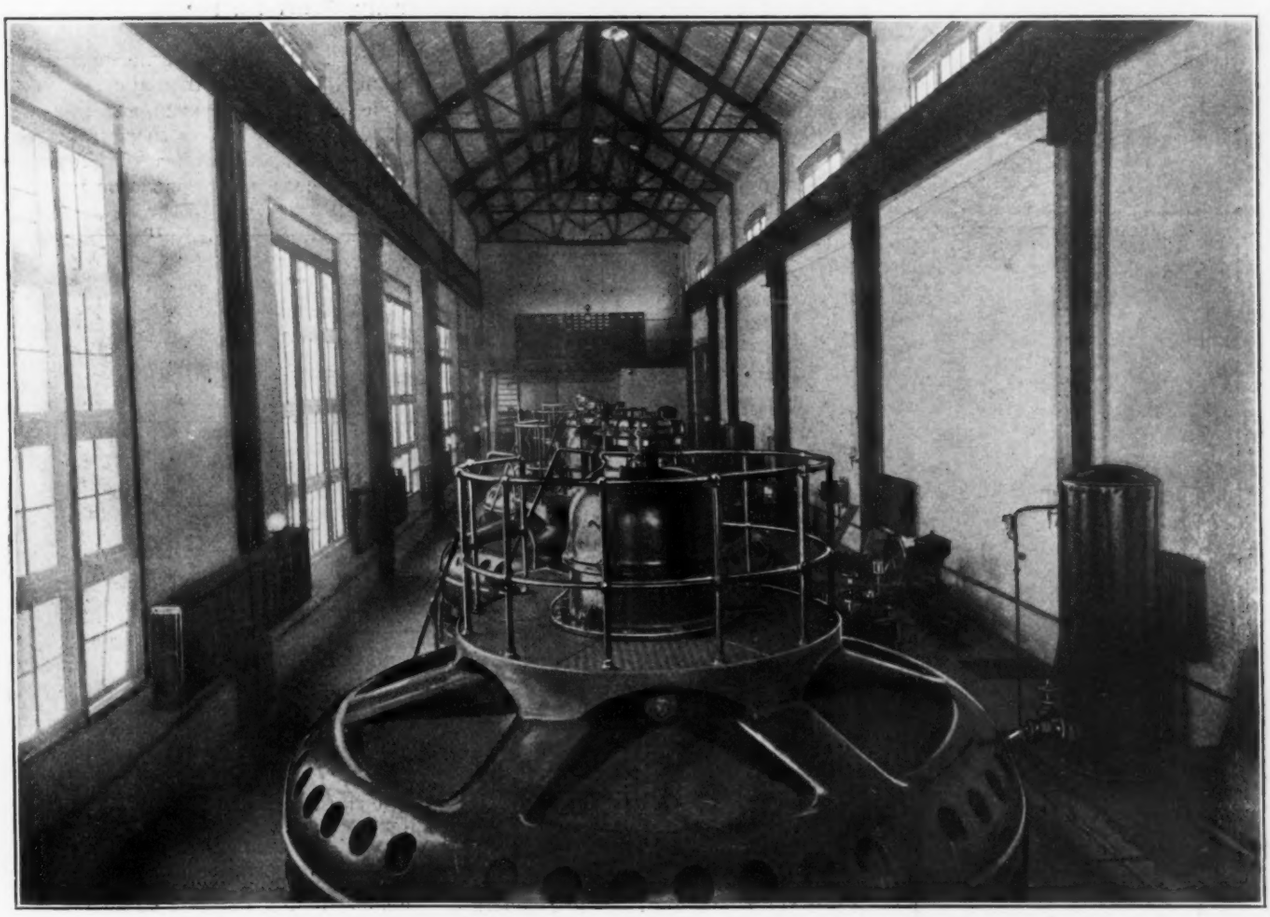


FIG. 1—MAIN GENERATOR ROOM, AUGLAIZE POWER COMPANY, LOOKING TOWARD SWITCHBOARD

dredged from the large government reservoir near St. Mary's, Ohio, which will add a flow of 700 cu. ft. per second to the stream. It is said that with this concession added to the natural stream flow sufficient water will be available to operate two of the station units at all times. Hope is also expressed that in the near future contracts will be consummated which will allow secondary power from the remainder of the station to be delivered over a transmission line to Toledo during a portion of the year.

Dam and Headworks

The dam, which was built by the Ambursen Hydraulic Company, is made up of twenty-five 15-ft. bays, with a total length of 375 ft. Three Tainter gates, each 30 ft. wide, and the main generating room of the power house, 145 ft. long, are also built across the bed of the stream and form part of the dam. At this point the river is 610 ft. wide, and under normal conditions the dam furnishes an effective head of 26 ft.

A floating boom has been placed at a sharp angle from the outboard corner of the power house to the bank of the river to deflect large floating masses of débris and ice to the Tainter-gate openings. Iron screens at each wheel intake are depended upon for intercepting the smaller river trash. As will be seen from the plan of the generating room of the station (Fig. 2) the gates are hoisted from a 10-ft. gatehouse running the full length of the station on the upstream side. The hoisting mechanism, also shown in Fig. 2, is driven by a 4.5-hp motor taking energy from one of several outlets in the wall along the track. There are in all eleven gates—two for each generator and one for the exciter unit. The gate hoist is able to raise a single gate in about fifteen minutes.

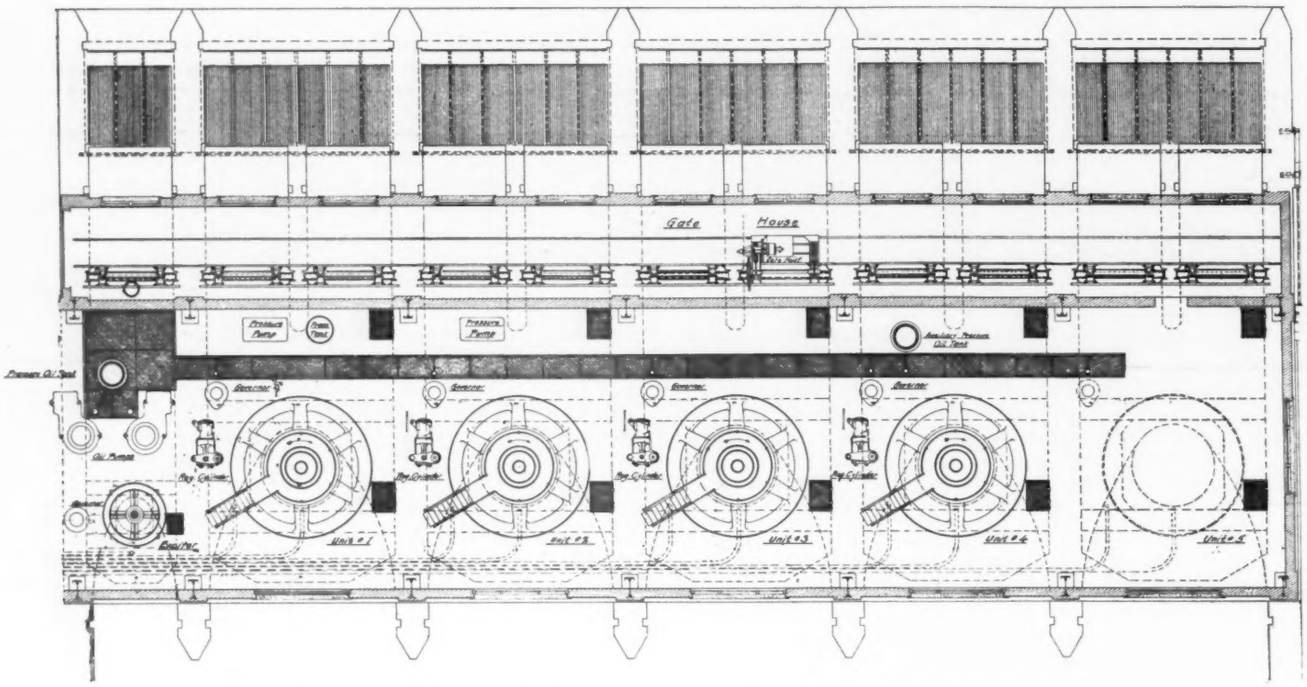


FIG. 2—PLAN OF GENERATING ROOM, AUGLAIZE POWER COMPANY, PLANT NO. 1

FIG. 3—TURBO-EXCITER AND MOTOR-DRIVEN OIL PUMPS

FIG. 4—OIL SWITCHES IN HIGH-TENSION BUS ROOM

Generating Equipment

The generating equipment of the station consists of five Allis-Chalmers 1000-kva, 2300-volt, 25-cycle, three-phase, Y-connected, revolving-field alternators spaced in a single

row down the middle of the plant at a distance of 23.5 ft. between centers. The vertical turbine wheels, which run at a speed of 94 r.p.m., measure 9 ft. in diameter, and each is equipped with twenty buckets. All wheels are of the single-runner type and the weight of the rotating element is carried by a hung bearing shown at the top of the machines. Three guide bearings spaced along the vertical shaft keep the rotating parts in alignment. Both the main bearings and the guide bearings are water-cooled. With the water level at the spillway crest a 22-ft. head is obtainable at the wheels.

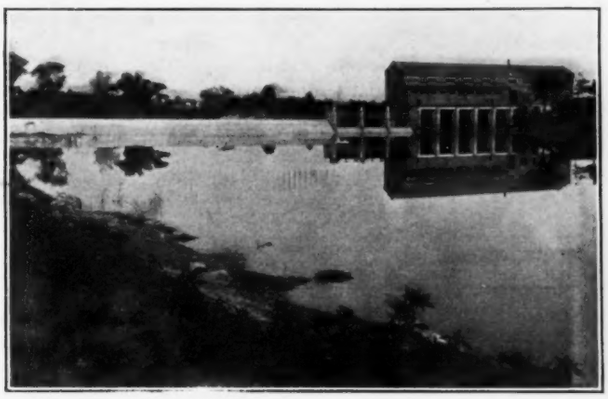


FIG. 5—POWER HOUSE, DAM AND TAINTER GATES, UPSTREAM SIDE

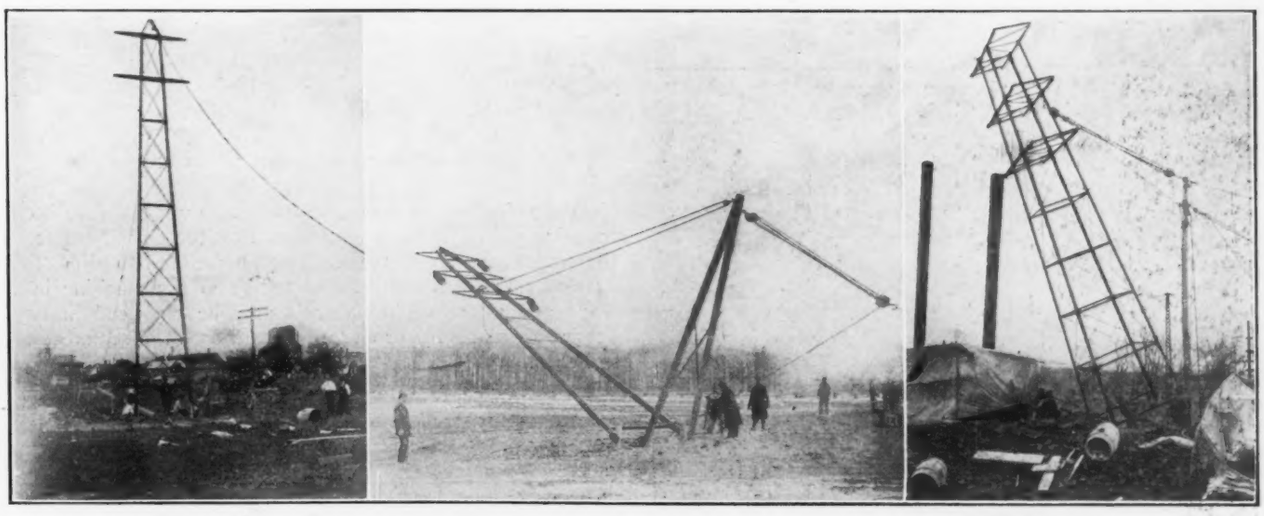
FIG. 9—WATER FLOWING AROUND THE END OF DAM AFTER THE FLOOD

The turbine bearings are oiled from the floor of the station by an automatic pump which supplies hard oil at pressures varying from 2000 lb. to 300 lb. per sq. in. A pressure relay in the oil system controls the automatic starter of the motor-driven oil pump. The turbine governors are all supplied with oil at 160 lb. pressure from a central oil-pressure system. The two 25-cycle, 220-volt, 40-hp motors driving this apparatus are automatically started and stopped by the pressure variations of the system. Two motor-driven pumps supply water at a pressure of 40 lb. to the transformers and generator bearings and for other general purposes.

The exciter equipment is divided into three units, one of which is a 125-kw, 125-volt machine driven by a vertical waterwheel of the same type as the large units. This exciter is used only when the water supply is plentiful. The other two units are driven by 25-cycle, 2300-volt induction motors and are capable of producing 125 kw and 75 kw respectively. All of the exciters are wired so that they may be switched to a common bus from which energy is distributed to the field windings of the alternators. A 40-ton crane built by the Northern Engineering Works, Detroit, Mich., serves all portions of the generating room.

Two low-pressure steam boilers heat the station in winter and also furnish steam for heating and other purposes in the homes of the station operators which have been built on the river bank about 100 yd. from the power house. In case of the entire disablement of the water-driven equipment, steam may be taken from these boilers to drive a small horizontal engine belted to a direct-current generator, rated at 172 amp at 125 volts.

For stepping up the voltage as the energy leaves the station destined for Maumee five three-phase, 1000-kva, 2300/34,600-volt, 25-cycle, composite-type transformers have been installed. These water-cooled units were furnished by the General Electric Company and have both their primary and secondary windings connected in delta. The transmission line to Defiance is supplied through three single-phase, 2300/6600-volt, 400-kva Allis-Chalmers transformers which are also connected with windings in delta. The local alternating-current supply required by the station lighting and auxiliaries and by the lighting in the operators' houses is furnished through three single-phase, 125-kw, 2300/220/110-volt, delta-to-delta transformers. Each of the main banks of transformers feeding the line



FIGS. 6, 7 AND 8—TRANSMISSION-LINE A-FRAME AND STRAIN TOWERS IN PROCESS OF ERECTION

to Maumee is protected on the transmission-line side by aluminum-cell lightning arresters designed for use on circuits operating at 60,000 volts. On the Defiance line 13,000-volt arresters of the same type are used.

Switchboard and Switching Equipment

In the combination panelboard and benchboard located

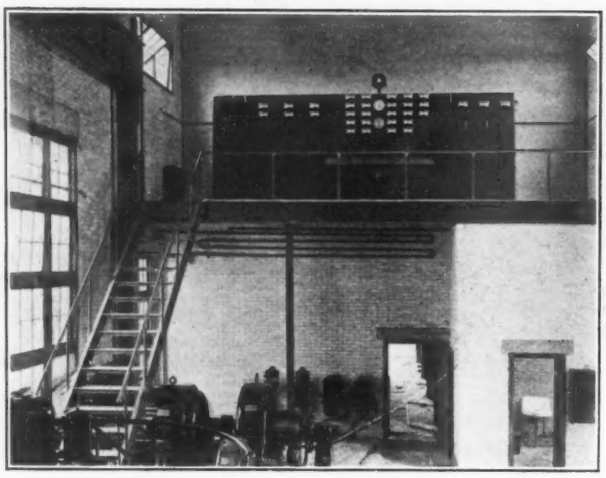


FIG. 10—SWITCHBOARD GALLERY

on an elevated gallery at the south end of the generating room is centered the control of the entire station. Small synchronizing motors on the governor stands are controlled from the benchboard so that any machine may be started, brought up to speed and with the aid of remote-controlled switches may be placed on the busbars by a single operator on the switchboard gallery. All remote-control switches are of the solenoid type. By proper switching from the benchboard it is possible to obtain any combination of machines or transformers desired by the operator. Of the eleven panels which go to make up the board, three are exciter panels, three are meter panels, three switching and relay panels, one carries the Tirrill regulator, and one serves for switching the local load. The exciter panels carry the remote-control starters, field-rheostat handles and

FIG. 11—COMPOSITE TRANSFORMER

instruments. The rheostat resistors are mounted back of the board. The three meter panels are fitted with one alternating-current voltmeter, an ammeter, a wattmeter and a direct-current field ammeter for each waterwheel unit. The main ammeter and voltmeter are arranged so that they may be switched to read respectively current in any phase and voltage between any two legs of the line. On these panels are also provided ammeters for measuring outgoing current. At the middle and above the board an electrostatic ground detector is supported on an iron standard. Both synchroscope and synchronizing lamps are used for paralleling the machines on the buses. The output of each generator is measured and recorded by five recording wattmeters, these instruments being placed on the rear of the switchboard.

The extensive switching facilities provided at this station allow any piece of the apparatus or any portion of the wiring to be cut out of the circuit. The most spectacular switching installation in the station is found in the room above the transformers, where six sets of 70,000-volt, three-phase remote-control oil switches are located. One bank of these big machine switches is provided for each alternator and an additional set connects the high-tension bus with the Maumee transmission line. In connection with the latter set of switches three high-tension ammeters are installed in the outgoing lines and time-limit relays equipped with auxiliary tripping devices protect the station equipment from short-circuit and high-potential surges on the line. Disconnecting switches with safety latches are placed between the oil switches and the high-tension bus.

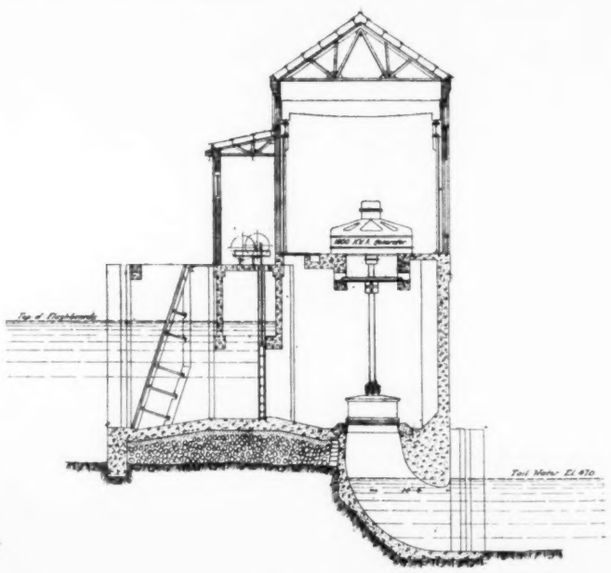


FIG. 12—SECTION THROUGH POWER HOUSE

Two additional groups of disconnecting switches have been installed to enable the operator to open the circuit between the transformers and the low-tension bus and to allow the 2300-volt leads to be disconnected from the machine bus. Thus any phase of any circuit may be cut dead in any particular place by proper manipulation of disconnecting switches.

Transmission Lines

The two transmission lines extending from the station of the Auglaize Power Company transmit energy to the towns of Maumee and Defiance, Ohio. The line to Maumee is 53 miles long and is operated at 34,600 volts, and the one to Defiance is 4 miles long and is operated at 6600 volts. Steel towers of the A-frame type are used on both lines. Illustrations herewith show two of the A-frame towers and also the strain tower at the station in process of erection.

Mr. Harden T. Crawford, New York City, is president of the Auglaize Power Company and Mr. W. P. Wallace, Toledo, Ohio, is manager. The general scheme of development was planned by Mr. R. R. Livingston, consulting engineer, New York City.

The Waterside Turbine Station at Louisville, Ky.—II

Electrical equipment and switching apparatus for 6600-volt and 2200-volt circuits—Special calibrating panels on switchboard—Use of colored wire, labeling and designation of phases—Plant work-order system

THE preceding article of the above title, which appeared in the *Electrical World* of Oct. 25, described the general features of the prime-mover equipment in the Waterside station of the Louisville (Ky.) Gas & Electric Company, including a reference to the unusual condenser-pit arrangement by which, to accommodate the 45-ft. rise and fall of the Ohio River at this point, the condensers are installed nearly 50 ft. below the turbine-room floor. Details were also given of the arrangement of steam headers by which the use of traps is avoided.

The following paragraphs relate particularly to the electrical apparatus in the plant, special attention being given to the auxiliary and switching equipment, and to improved operating features devised locally.

Auxiliary Electrical Equipment and Switchboard

In addition to the main generating units, the turbine room contains two General Electric rotary converters rated at 200 kw each, one 500-kw Westinghouse synchronous motor-generator set, one General Electric turbine-driven 125-volt exciter and one motor-driven exciter, and a 5.5-kw General Electric 220-volt motor-generator which supplies energy for the operating storage battery.

The synchronous motor-generator set operates on 6600-volt three-phase energy and supplies electricity at 600 volts for commercial-motor load. The field excitation of the synchronous motor is adjusted to give 70 per cent leading power-factor, to aid in correcting the inherent lagging power-factor of the system. This set is started by a compensator and oil switch located below the floor but is controlled from the switchboard. A 8.5-kw, 125-volt exciter is mounted on one end of the shaft of the machine.

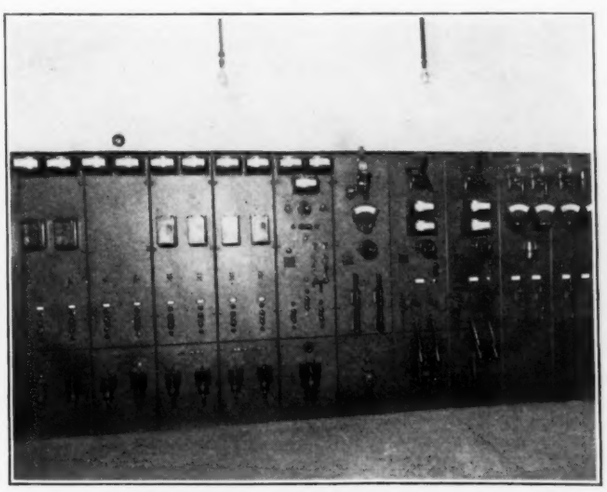


FIG. 7—DISTRIBUTION SWITCHBOARD, CONCRETE WALL ABOVE PANELS CONCEALING CONDUIT

The two 200-kw, 600-volt rotary converters also furnish direct-current motor service. Each of these machines is provided with a compensator, a field break-up switch and 2200/390-volt transformers so that they may be started up from the alternating-current side.

At the north end of the turbine room is the operating engineer's office. Here complaints and work-order blanks are filed by a card-index system and station log sheets are inspected to ascertain where savings can be instituted. Tabulations of cost of labor and material on repair jobs make it a simple matter for the operating engineer to estimate the cost of similar jobs in the future. Every possible

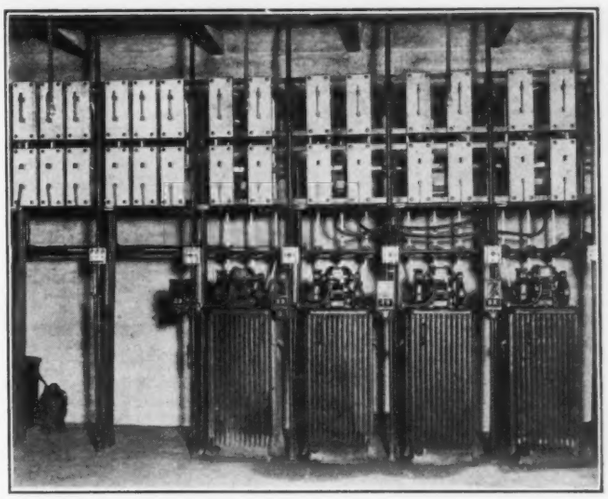


FIG. 8—SINGLE-PHASE REGULATORS ON 2200-VOLT LIGHTING CIRCUITS

effort is made to give the men about the plant an understanding of the operation of the apparatus and the reasons for the various readings and measurements taken and reported.

The "switchboard room," or space occupied by the benchboard and vertical switchboard, which are on the engine-room floor level, is 18 ft. wide and extends the entire length of the station. One end of this space is utilized for the feeder regulators and air-blast transformers. The benchboard is divided into six panels—two for the 2000-kw and 4000-kw turbo-generators, three for the 500-kw vertical turbo-generators in the adjoining old station, and one for the two exciter units. Supported on pedestals above the benchboard are six meter panels, on which, in addition to the usual instruments, there are mounted three-blade, double-throw, broken-back knife switches, normally held in the upper position by a spring. When it is desired to read on the wattmeter the wattless component of the energy being supplied by the generators, the corresponding switch is thrown down.

Placed on a swinging bracket at one end of the benchboard are six voltmeters, a synchroscope and a frequency meter. Another large synchroscope is placed on the wall where it can be seen from any part of the turbine room.

On each of the benchboard panels is a signal device connecting with a similar signal on the pedestal beside the corresponding generator. The generator field switches are interlocked with the synchronizing plug receptacles and the remote-control switches so that the field switches cannot be opened while the main switch is closed, nor can the main switch be closed unless the synchronizing plug is inserted. Telephonic communication can also be obtained with different parts of the station and with the electrical

engineer's office. One master clock over the exciter panel operates all of the printometer devices in the station.

Special Calibrating Panels

All of the instruments on the benchboard, as well as those on the distributing panels, can be calibrated without removing them from the panels by connecting a portable testing set of terminals onto a special calibrating panel on the back of each instrument panel. On this panel are terminals which connect with potential terminals of the instruments on the respective panels. These are normally connected to

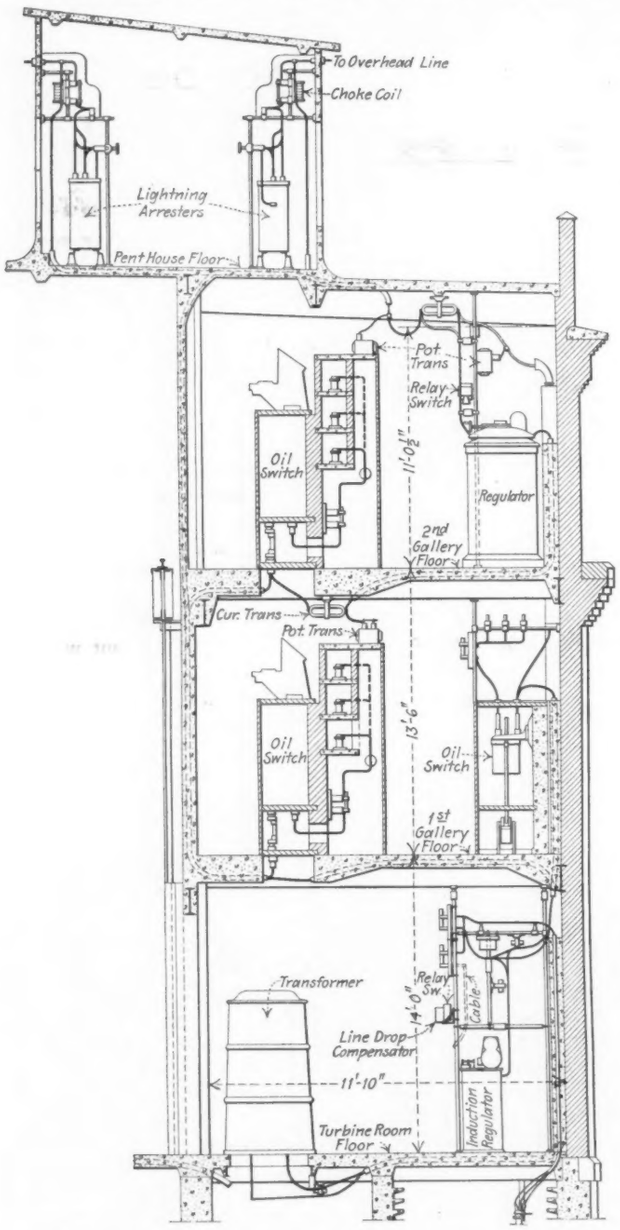


FIG. 9—OIL-SWITCH GALLERIES OVER SWITCH ROOM

potential transformer terminals (also on the panel) by copper bridges. In its upper position, a four-blade, double-throw, broken-back knife switch connects the current terminals of the instruments to the current transformers, and when in its reverse position short-circuits and grounds the transformers. The operating circuit of the overload relay is connected through the fourth pole of this switch, so that a gap can be made on the circuit when the instruments are being tested to prevent the accidental opening of circuit-breakers.

When testing instruments, the potential terminals are disconnected from the potential transformers and connected by flexible cord and clips to the portable set. The broken-back switch is placed in the lower position, and current clips from the portable set are inserted in the upper clips of the switch. These clips are of different design so that there is no danger of mistake in connecting the portable set to the calibrating panel.

The vertical switchboard controls the underground and overhead feeder circuits. The construction of this board, the arrangement of the building to accommodate it and the utilization of colored wires to facilitate tracing circuits are among the main features of this portion of the switchboard room.

Colored wire is used throughout the station to facilitate tracing instrument circuits in case any instrument becomes inoperative. Oil-switch control wiring has its individual color to distinguish it from the wires running to indicating and recording instruments. Potential and current wires, similarly, have designating colors, and different phase wires have the same color scheme throughout the system. The busbars are arranged in a definite order so that the phases can be distinguished by their position without referring to a chart. Where the buses are arranged horizontally the phases read A B C from east to west or from north to south, as the case may be. When placed vertically they read from the top down. All the buses in the switchboard room both low-tension and high-tension (except

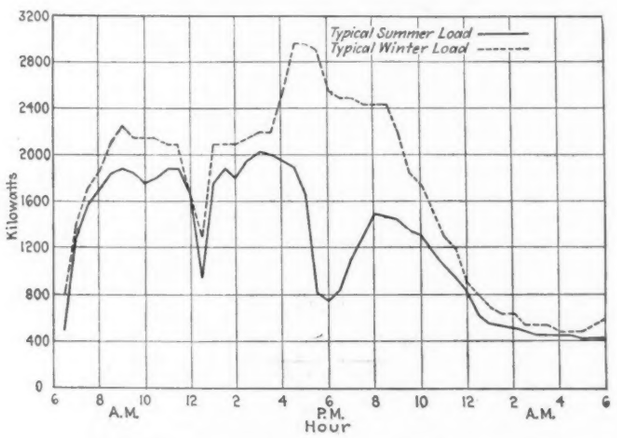


FIG. 10—TYPICAL SUMMER AND WINTER LOADS, 1913, WATERSIDE STATION

6600 volts) are covered, not to prevent flashovers, but to protect against short-circuit due to some tool falling across them. Next to the bus is a layer of fiber bent to conform to the shape of the bus, and surrounding this is a layer of empire cloth. Two exciter buses are installed for emergency. The turbine-driven exciter is used only rarely, the motor-driven set being operated ordinarily.

The 2300/4600-volt alternators at present supply 2300-volt energy to three 1500-kw sets of Westinghouse 2300/6900-volt step-up transformers, the low-tension buses of which are sectionalized in order that the generators and transformers may be grouped into independent systems if desirable. Two of the transformers are of the three-phase, air-cooled type, while the other set consists of three single-phase, delta-connected, oil-cooled transformers having a combined rating of 1500 kw.

As the generating equipment is increased and the necessity of a more extensive high-tension district becomes imperative, the connection of generators and transformers on the 2200-volt and 6600-volt buses will be reversed. In other words, the generators will be connected to supply 4600-volt energy to compensators which will step the pressure up to 6900 volts. Energy at this voltage will then be supplied direct to the nominal 6600-volt buses, and the transformers which are now being used as step-up units

will be used to step down to 2300 volts for the nominal 2200-volt bus. This change will be made provided, of course, that the extent of the high-tension district warrants it. The entire station has been laid out with this reversal of conditions in view.

Each main generator switch is grouped with the 2200-volt switch of a step-up transformer and with a number of 2200-volt feeder-line switches, which can thus be supplied with energy by the particular generator without assistance from an outside source. With this arrangement it is possible to sectionalize the bus and operate each generator independently of the others. Above each compartment containing a 2200-volt distributing oil switch is a marble panel on which are mounted two single-blade, double-throw knife switches used to connect the single-phase feeders to different phases where it is necessary to balance the load on the three-phase system. The sectionalizing switches for the 2200-volt bus are mounted horizontally and have special locks to prevent their being opened by gravity or current surges. Two "dogs" close over and grip the blade automatically when the switch is closed. The 6600-volt oil switches are actuated by motors, while the 2200-volt switches are operated by solenoids. The 6600-volt buses consist of flat copper bars supported on vertical porcelain insulators, connections being made with copper

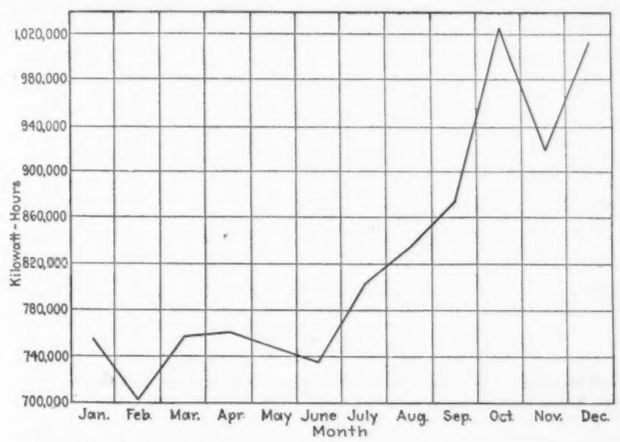


FIG. 11—KILOWATT-HOURS GENERATED BY MONTHS, 1912

tubing. Duplicate buses are employed to permit flexibility in operation.

FEEDER REGULATORS

Located on the second gallery are six voltage regulators, four of which, rated at 150 amp each, are used on the 2200-volt system for supplying energy to combined motor and lighting loads. Regulation is applied in the one lighting phase only. Two three-phase, 100-amp regulators adjust the voltage of the 6600-volt motor circuits. Lightning protection is provided by General Electric electrolytic lightning arresters. Each feeder regulator is provided with a potential transformer and a plug receptacle which connects with a recording voltmeter in the switchboard room, by means of which any circuit on which there is a complaint of voltage variation can be investigated without setting up special apparatus for the purpose.

Eight single-phase, 150-amp lighting regulators for the 2200-volt lighting circuit are installed on the main floor of the station at the north end of the switchboard room. Supplementing the station lighting from the alternating-current mains, in case of plant shut-down, emergency service is automatically supplied by a no-voltage release switch which connects the station service system to the storage-battery bus, used normally to furnish current for oil-switch operation and signals.

Feeder circuits are conducted to their destinations as overhead lines and through underground conduits. The overhead circuits are carried up to the penthouse above the second gallery, in which the multi-gap and electrolytic lightning arrester equipment is installed.

Two subways are provided for the underground circuits leaving the generating station, although only one of these tunnels is being used at present. The cables are brought down from the oil switches or regulators in fiber ducts to a concrete cable rack in the basement. At each end of

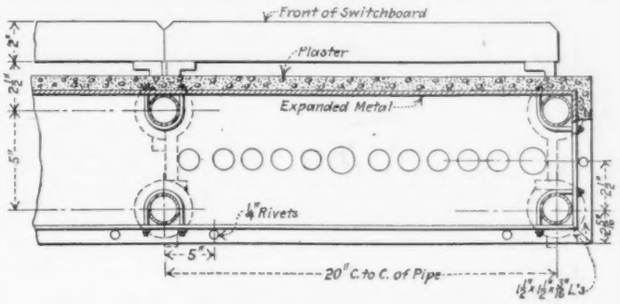


FIG. 12—PUNCHED PLATE USED AS TERMINAL PLATE FOR CABLES APPROACHING SWITCHBOARD FROM ABOVE

the rack is a manhole which communicates with one of the subways previously mentioned. On the cable-rack potheads, as well as on the switchboards, feeder regulators and other apparatus the circuits are numbered, each 2300-volt and 6600-volt line having the prefix figure "2" or "6" added respectively to the number of the circuit to indicate the potential of the circuit.

Each of the electrolytic lightning arresters is connected to a relay in such a manner that when there is a discharge to ground an annunciator drop is released in the switchboard room and a bell continues to ring until the drop is restored to its normal position. In this way there is brought to the attention of the operator any disturbance which is too insignificant to damage machinery but which may lead to future trouble. Similar alarms are provided for the overload relays which light incandescent lamps. The turbine room is served by a 40-ton double-hoist alternating-current crane.

Sargent & Lundy, engineers, Chicago, designed and supervised the construction of the Waterside station.

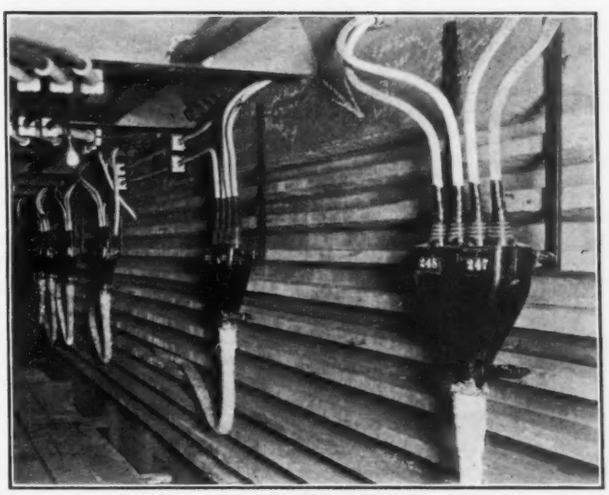


FIG. 13—CONCRETE CABLE RACKS IN BASEMENT LEADING TO SUBWAYS

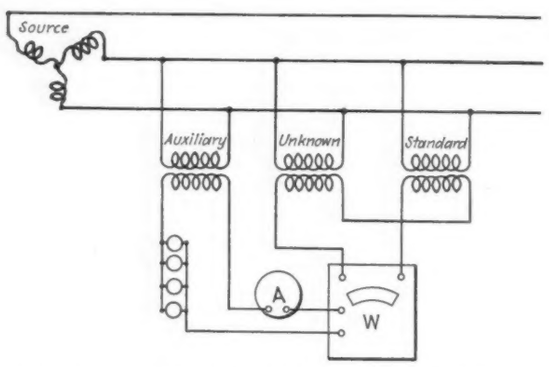
The officers of the Louisville Gas & Electric Company are as follows: President, General George H. Harries; vice-president, Mr. Donald McDonald; superintendent of electrical department, Mr. G. Wilbur Hubley; treasurer, Mr. T. B. Wilson; secretary, Mr. Thomas W. Kennedy; consulting engineer, Mr. L. S. Streng.

Testing Shunt Instrument Transformers[1]

By H. B. Brooks

The ratio and phase angle of an instrument transformer may be accurately determined by laboratory methods. The commercial importance of such transformers has stimulated the development of accurate methods in recent years.[2] In many cases, however, it is not practicable to dismount transformers and send them to a laboratory, and a method is wanted which, while giving all needed accuracy, can be carried out at the point of installation, using commercial instruments and the ordinary supply voltage. Such a method of testing potential instrument transformers will now be described. No claim for originality of principle is made, as the only novel feature is the use of facilities which are available in any properly equipped alternating-current power plant, in addition to a potential instrument transformer the ratio and phase angle of which are known.

Briefly, the idea of the method is as follows: From the practical point of view, an error in ratio or phase angle which produces a visible error in the reading of an indicating watt-meter is an error which needs to be known, while errors smaller than this are negligible. Use may therefore be made of an indicating wattmeter in such a way that differences in ratio or phase angle of an unknown



CONNECTION FOR TESTING STANDARD AND UNKNOWN TRANSFORMERS

transformer and a standard transformer have the best possible opportunity to produce a deflection. By properly choosing conditions, this deflection may be readily made to give the numerical values of the quantities which are desired.

The primary windings of the standard transformer and the transformer to be tested are connected to the same supply system, as shown in the accompanying illustration. The secondary windings are connected in series so that their voltages are opposed. The secondary voltages will be nearly equal and will rise and fall in unison as the line voltage varies. The thing to be measured is the difference between the two secondary voltages, which difference in general would be only a few volts. As the lower end of the scale of an alternating-current voltmeter is practically useless, this small voltage cannot be measured satisfactorily with even a low-range voltmeter. However, a 5-amp indicating wattmeter may be used as a voltmeter by separately exciting its series coil.[3] This may be done by passing 5 amp through the coil to a lamp load. This exciting current must not be drawn from either of the two transformers whose ratios are to be compared, but must come from the secondary of any other available transformer connected to the same phase as the transformers under comparison. The current through the series coil of the wattmeter should be kept at approximately 5 amp, but this current needs to be measured with only moderate accuracy. The shunt circuit of the wattmeter may now be used as a voltmeter to measure the small difference in the secondary voltages of the two transformers under comparison. For example, if the wattmeter is made for 5 amp, 150 volts, 750 watts, and has a 150-division scale, then one division is 5 watts and will be given by 5 amp in the series coil and 1 volt on the shunt circuit; hence the difference between the two secondary voltages, in volts, will be shown by the number of divisions deflection of the wattmeter. Since the ratio of good potential instrument transformers changes very little with ordinary fluctuations of line voltage, the difference of the secondary voltages will be practically constant. As the wattmeter reading is steady and can be taken to one-tenth of a division, the ratio of one transformer in terms of the other can be read to 1 in 1000. If the wattmeter has a 75-volt range, this may be used and the reading will be doubled; that is, one volt difference between voltages will be given two divisions deflection. It is obvious that with a wattmeter having a still lower voltage range, say 30 volts,[4] the difference between the secondary voltages could be still more accurately read.

The question as to which transformer has the greater ratio may be easily answered from the fact that increasing the non-inductive load on the secondary always lowers the secondary voltage and thus increases the ratio of transformation. If the reading of the wattmeter is up scale when there is no load on the secondary of the transformer under test, and if this reading increases as successive lamps are connected to the secondary of the transformer under test, the voltage of this transformer at no load is lower than that of the standard transformer. Similarly, if the deflection is below zero with no load and the addition of load brings the deflection up through zero to a reading on the scale, the voltage of the transformer under test at no load is higher than that of the standard transformer. In this case the potential leads should be reversed at the start to bring the readings on the scale; they will decrease as the load is gradually applied and pass through zero, when the leads may be replaced in the original position.

It is obvious that the above method is a suitable one for determining the regulation of "power" transformers, by using one transformer of a bank on no load as the standard transformer and determining the drop of voltage of another transformer as the load on it is increased. This method is similar in principle to the one described by Drysdale,[5] but differs in important details. In his method the shunt circuit of the wattmeter is connected to the secondary of the standard transformer, and the series coil of the wattmeter, with some added resistance, is used as a low-range voltmeter to measure the difference of the secondary voltages. The method described in the present article inverts these uses of the two coils, the series coil being the one which is separately excited and the shunt circuit being used as the low-range voltmeter. This has the advantage of drawing a very much smaller current from the transformers under comparison and thus avoiding what might be an appreciable error in the case of small transformers.

If the preceding test for ratio is made with the primaries connected to one phase of a two-phase circuit, a determination of the difference of the phase angles of the two transformers may then be made by connecting the wattmeter series coil and 5-amp lamp load to the other phase. Before doing this, the ratios of the transformers should be made

[1] From a forthcoming article in the *Bulletin* of the Bureau of Standards.

[2] Rosa and Lloyd, *Bulletin* of the Bureau of Standards, Vol. 6, page 1; 1909; Reprint No. 116. Agnew and Fitch, *Electrical World*, Vol. 54, page 1042; 1909; Reprint No. 130. E. Orlich, *Elektrotechnische Zeitschrift*, Vol. 30, pages 435 and 466; 1909. L. T. Robinson, *Trans.* Am. Inst. Elec. Eng., Vol. 28, page 1005; 1909. F. A. Laws, *Electrical World*, Vol. 55, page 223; 1910. Sharp and Crawford, *Trans.* Am. Inst. Elec. Eng., Vol. 29, page 1517; 1910. Agnew and Silsbee, *Trans.* Am. Inst. Elec. Eng., Vol. 31, page 1267; 1912.

[3] A similar use of the wattmeter is described by Drysdale, London, *Electrician*, Vol. 57, page 783; 1906.

[4] With this range, at 60 cycles, no error due to mutual inductance enters, for two usual types of portable wattmeter. It is not advisable, in general, to reduce the range below 30 volts.

[5] London *Electrician*, Vol. 65, page 644; 1910.

equal by loading the secondary of one or the other with lamps or other non-inductive load.[6] The current taken by this load should be determined. If it must be applied to the standard transformer in order to make the ratios equal, the value of phase angle of the standard transformer corresponding to the given load may be taken from a curve plotted from the certified values.[7] The small voltage shown by the wattmeter with its series coil on the second phase is a measure of the difference of the phase angles of the two transformers with the given secondary loads. For example, suppose that the wattmeter constants are those previously referred to and the 150-volt shunt circuit is in use, so that one division deflection is given by 1 volt applied to the potential circuit. Suppose the deflection is 0.3 division when the 5-amp current in the series coil is drawn from the second phase of the two-phase circuit while the primaries of the two potential instrument transformers are on the first phase. The 0.3 volt divided by the secondary voltage (say 110) of the transformer under test equals 0.0027. This number is the sine of the small angle by which the phase angles of the two transformers differ. By reference to a table of natural sines,[8] the angle is found to be nine minutes. Hence 0.1 division of the wattmeter corresponds to three minutes. By using the 75-volt range of the wattmeter 0.1 division will correspond to one and one-half minutes.

It remains to determine which of the two secondary voltages is leading the other. To test this point, advantage may be taken of the fact that increasing a non-inductive load connected to the secondary of a potential instrument transformer tends to make the reversed secondary voltage lag behind the primary voltage. With the connections made for phase-angle test as just described, and the wattmeter reading 0.3 division up the scale, connect one or more incandescent lamps to the secondary terminals of the transformer under test, without disturbing any of the former connections. If the deflection of the wattmeter is increased, a reading-up scale denotes that the secondary voltage of the transformer under test lags behind that of the standard transformer. If the application of the lamp load to the transformer under test sends the wattmeter reading down below 0.3 division, a reading-up scale denotes that the secondary voltage of the transformer under test leads that of the standard transformer.

If a two-phase circuit is not available, three-phase to two-phase arrangement of transformers may be used. If this is not convenient, the test for phase angle may be made by exciting the wattmeter series coil from another phase of a three-phase circuit. In this case, however, the wattmeter reading must be multiplied by 1.16 (the reciprocal of 0.866) in order to get the deflection which would be given if test were made on a two-phase line. The calculation is then made as before. The phase-angle test may also be made with the series coil connected to the third phase as a check. If the deflections are slightly different from those obtained when phase two is used, the mean of the two values may be taken.

In the illustration no connected load is shown on the secondary of the transformer whose ratio and phase angle are to be determined. However, any desired load may be connected to it and the comparison made in the same way. The load is simply connected to the secondary terminals without disturbing any of the other connections.

To test the accuracy of the foregoing method, two 5500-to-110-volt potential instrument transformers were compared at three secondary loads. The test was then repeated, using an accurate laboratory method. The values for ratio by the two methods agreed to within 0.02, 0.05 and 0.08 per cent for the three loads, which were respectively light load, rated load and twice rated load. The values of phase angle by the two methods agreed to within less than half a minute. The wattmeter used was arranged with a 30-volt potential range especially for the test.

[6]The writer is indebted to Dr. P. G. Agnew and Mr. F. B. Silsbee for this and other helpful suggestions.

[7]Such an interpolation is easily made, since the ratio and phase angle curves of potential instrument transformers are sensibly straight lines.

[8]If a table of natural sines is not available, the angle (in minutes) may be obtained by multiplying the quotient of the two voltages by 3438; thus, 0.0027 times 3438 equals 9+. This assumes that the sine of a small angle is equal to the angle expressed in radians. For the small phase angles of instrument transformers this assumption introduces no appreciable error.

Effect of a Short-Circuited Secondary on an Oscillating Circuit

By Louis Cohen

In a recent discussion at a meeting of the Institute of Radio Engineers* a question arose regarding the effect of short-circuiting the overhanging turns of an inductance coil in an oscillating circuit, as indicated in the illustration on the next page.

Some maintained that the short-circuiting of the overhanging turns produces large damping in the oscillating circuit, while others declared that their experience with such an arrangement had not shown any bad effects. It would appear that there exists some misunderstanding about the problem, and it will perhaps be of some interest to indicate briefly the mathematical solution of the problem, and to show that both views may be justifiable. It is all a question of the relative magnitudes of L_1 and L_2 and the mutual inductance between the coils L_1 and L_2.

Mathematically the problem is the same as that of the oscillation transformer. To simplify the discussion, assume a sine emf (undamped) acting on the oscillating circuit; we have then the well-known transformer differential equations for the two circuits, which are as follows:

$$\left.\begin{aligned} L_1\frac{dI_1}{dt}+R_1I_1+\frac{1}{C_1}\int I_1dt+M\frac{dI_2}{dt}&=E\varepsilon^{i\omega t}\\ L_2\frac{dI_2}{dt}+R_2I_2+M\frac{dI_1}{dt}&=0\end{aligned}\right\}(1)$$

Solving these two equations, we get for the absolute values of the currents in the two circuits:

$$\left.\begin{aligned} I_1&=\frac{E\sqrt{L_2^2\omega^2+R_2^2}}{\sqrt{\left\{(M^2-L_1L_2)\omega^2+\frac{L_2}{C_1}+R_1R_2\right\}^2+\omega^2\left\{L_2R_1+L_1R_2-\frac{R_2}{C_1\omega^2}\right\}^2}}\\ I_2&=\frac{EM\omega}{\sqrt{\left\{(M^2-L_1L_2)\omega^2+\frac{L_2}{C_1}+R_1R_2\right\}^2+\omega^2\left\{L_2R_1+L_1R_2-\frac{R_2}{C_1\omega^2}\right\}^2}}\end{aligned}\right\}(2)$$

The circuit may be tuned in two ways: it can be tuned without any regard to the secondary circuit, or the system as a whole can be tuned including the secondary circuit.

In the first case $L_1\omega-\frac{1}{C_1\omega}=0$, and the expression for I_1 in equations (2) reduces to

$$I_1=\frac{E\sqrt{L_2^2\omega^2+R_2^2}}{\sqrt{(R_1R_2+M^2\omega^2)^2+R_1^2L_2^2\omega^2}}\qquad(3)$$

In the second case, tuning the system as a whole,

$$(M^2-L_1L_2)\omega^2+\frac{L_2}{C_1}=0$$

or

$$\omega^2=\frac{1}{L_1C_1(1-K^2)},\left(K^2=\frac{M^2}{L_1L_2}\right)\qquad(4)$$

*Proceedings of the Institute of Radio Engineers, Vol. I, Part 2, pages 32, 33.

and the expression for I_1 in equation (2) (neglecting R_1R_2) becomes

$$I_1 = \frac{E\sqrt{L_2^2\omega^2 + R_2^2}}{\omega\left(L_2R_1 + L_1R_2 - \frac{R_2}{C_1\omega_2}\right)} = \frac{E\sqrt{L_2^2\omega^2 + R_2^2}}{\omega\,(R_1L_2 + R_2L_1K^2)} \quad (5)$$

If the overhanging coil were entirely removed and the oscillating circuit tuned to its natural period, we would have

$$I_1' = \frac{E}{R_1} \quad (6)$$

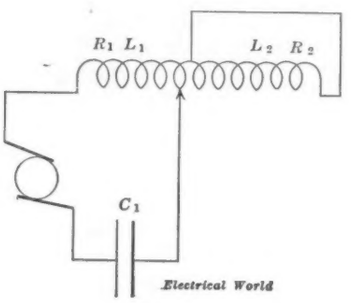
Comparing equations (3), (5) and (6), it is seen that by tuning the primary circuit alone, the presence of the short-circuited overhanging coil (or closed secondary) reduces the current in the primary circuit in the ratio,

$$y_1 = \frac{I_1}{I_1'} = \sqrt{\frac{R_1}{R_1^2 + \frac{2R_1R_2M^2\omega^2 + M^4\omega^4}{L_2^2\omega^2 + R_2^2}}} \quad (7)$$

Tuning the system as a whole, the effect of the closed secondary is to reduce the current in the primary in the ratio,

$$y_2 = \frac{I_1}{I_1'} = \frac{R_1\sqrt{L_2^2\omega^2 + R_2^2}}{\omega\,(R_1L_2 + R_2L_1K^2)} \quad (8)$$

An examination of equations (7) and (8) will show what effect the closed secondary may have under different conditions. If the overhanging coil consists of a large number of turns, so that L_2 is large compared with L_1 and M, the effect will be negligible and either by (7) or (8) $y = 1$ approximately.



SHORT-CIRCUITING THE OVERHANGING TURNS OF AN INDUCTANCE COIL IN AN OSCILLATING CIRCUIT

The greater the value of L_2 the closer the approximation. If, on the other hand, the overhanging coil consists of only a few turns, so that L_2 is small compared with L_1 or M, the effect may be very serious, and in some extreme cases the current in the oscillating circuit may be reduced to almost zero because of the closed secondary.

One or two illustrations will perhaps make it clearer.

Assume the case of a coil of 100 turns, length 10 cm, radius 5 cm, with ninety turns overhanging,†

$L_1 = 0.02$ mh., $L_2 = 0.59$ mh., $M = 0.024$ mh.

Assume $R_1 = 10$ ohms (including radiation resistance of antenna, if the coil is part of an antenna circuit).

$R_2 = 3$ ohms, $\omega = 10^6$.

For these constants we have by (7),

$$y_1 = \frac{10}{\sqrt{+100\frac{34{,}560 + 332{,}000}{348{,}000}}} = \frac{10}{\sqrt{101}} = 1 \text{ approximately}$$

By (8)

$$y_2 = \frac{10 \times 590}{10 \times 590 + 3} = 1 \text{ approximately.}$$

Short-circuiting the secondary has practically no effect on the current in the primary in this case. Suppose, however, that only thirty turns are overhanging. Then,

$L_1 = 0.42$ mh., $L_2 = 0.12$ mh., $M = 0.056$ mh.

Assume $R_1 = 10$ ohms, $R_2 = 1$ ohm, $\omega = 10^6$.

For these constants, by (7),

$$y_1 = \frac{10}{\sqrt{100 + \frac{11{,}090{,}000}{14{,}400}}} = \frac{10}{\sqrt{100 + 770}} = 0.34.$$

The current in the primary circuit is reduced to 34 per cent of the value that it would have if the secondary circuit were entirely absent.

If the system is tuned as a whole, including the secondary, we have by (8)

$$y_2 = \frac{10 \times 120}{1200 + 26.4} = 0.98.$$

For this case, tuning the system as a whole, the current in the primary will not be affected materially by the presence of the secondary.

Consider now an extreme case, the overhanging coil consisting of a single turn.

$L_1 = 0.68$ mh., $L_2 = 0.0003$ mh., $M = 0.006$ mh.

Assume $R_1 = 10$ ohms, $R_2 = 0.05$ ohms, $\omega = 10^6$.

By (7) $y_1 = 0.09$.

By (8) $y_2 = 0.33$.

For this case even by tuning the system as a whole the current in the oscillating circuit is reduced to one-third its normal value.

It is evident, therefore, that the effect produced by short-circuiting the overhanging coil depends altogether on the relative magnitudes of L_1, L_2 and M.

Experiments made some three years ago by the writer gave results which were in general in agreement with the above. It was suggested at that time that a single-turn secondary placed within the inductance coil so as to get the maximum mutual inductance and rotating it back and forth through 90 deg. would produce sufficient variation in current to serve as a means for sending signals in a wireless station in place of the key generally employed.

†For formulas to calculate the inductances, see paper on "Formulas and Tables for the Calculation of Mutual and Self Inductance," by E. B. Rosa and Louis Cohen, *Bulletin* Bureau of Standards, Vol. 5.

Sand-Blast Action of Desert Winds on Wires

By Arthur Palme

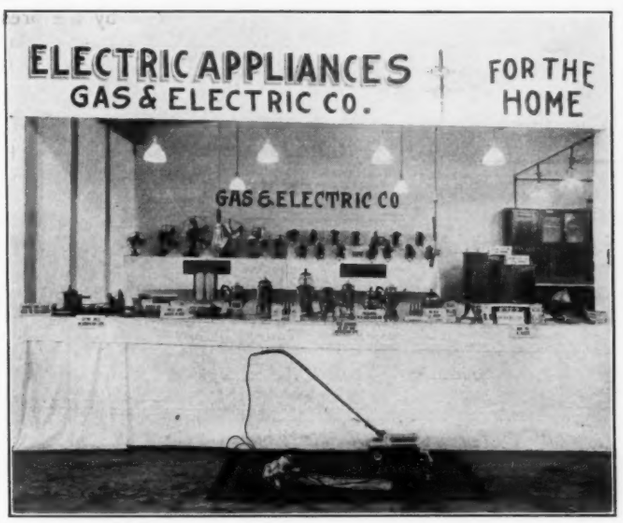
Overhead electric wires of any kind erected in Egypt in the vicinity of the African deserts suffer severely from the attacks of the fine sand blown about by the winds. Extending from Cairo to the Pyramids of Gizeh is an electric trolley line which is used chiefly by tourists. The trunks of huge palm trees serve as trolley poles to support the overhead conductor, and the contrast between the modern hurrying motor cars and the peaceful centuries-old tombs of the Pharaohs holds the interest of many a contemplative traveler. At one side of the trolley conductor on bell-shaped insulators are run the feeders, which like the trolley wire are of bright, hard-drawn copper. After these wires had been installed it was soon found that they invariably broke and fell within six to seven months, the cross-section being much reduced at the point of fracture. Investigation showed that the desert winds which sweep across the right-of-way whip sand particles against the wires, causing a filing action which cuts away the copper much like an artificial sand blast. The glass globes of arc lamps installed along the road have exhibited the same destructive action. A similar effect is observed with the incandescent units used to light the way to the Sphinx. These strings of lamps, besides having to be moved at frequent intervals to accommodate the varying level of the shifting sands, are rapidly eaten away by the etching action of the desert winds. Thus far no remedy has been discovered for this destruction except frequent renewals.

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

A Prize-Winning Central-Station Exhibit

At the Tri-State Fair held at La Crosse, Wis., during September, the exhibit of the La Crosse Gas & Electric Company won first prize. The display occupied two booths, one of which was devoted to electric appliances as shown in the accompanying illustration. A feature of the exhibit



PRIZE-WINNING DISPLAY BOOTH AT LA CROSSE, WIS.

which contributed to its success was the fact that everything shown was in actual use. Bread, cake and pies were baked and given away, along with boiled eggs, tea and coffee and other good things to eat and drink.

The apparatus exhibited included heating devices, irons and fans, vacuum cleaners, glassware, etc. The exhibit was in charge of Messrs. Frank H. Evans and Phillip Linker.

Line Extensions Into Sparsely Settled Territory

Inconsistency is sometimes revealed in the policies followed by some central stations in the making of line extensions into territory where the immediate returns do not seem commensurate with the necessary outlay, declared Mr. F. S. Nicholson, vice-president and general manager of the Sayre (Pa.) Electric Company, in addressing the recent New York convention of the Atlantic Gas & Electric Company.

A given electric-lighting company will cheerfully spend thousands of dollars for its equipment, power plant and initial distribution system, although having practically no assurance that sufficient business will ever be secured to cover the cost of operation. But after the first investment has been made and the plant is in operation, the policy is changed, and in the matter of small extensions the management often refuses to consider making any outlay of money without a positive guarantee against loss. It is, of course, history that many of the customers served by an electric-light plant must of necessity be served at a loss. The small consumers are of doubtful value and if analyzed separately would probably show a net loss at the end of the year. But when taken and combined as a whole with other customers, declared Mr. Nicholson, they tend to swell the net earnings rather than diminish them. For this reason, insisted the speaker, an earnest effort should always be made to care for any of these residents that apply, regardless of the fact that for the time being they must be taken at an apparent loss to the operating company. It will be only a matter of twelve to eighteen months until practically all of the extensions thus made will be returning a profit to the company.

Salem (Mass.) Central Station Discards Horses

The Salem Electric Lighting Company, of Salem, Mass., has discontinued the use of its entire horse-drawn equipment, and its transportation work from now on will be done entirely by motor vehicles. The company has a fleet of eight automobiles, six of which are electric machines, ranging in size from a runabout to a 2000-lb. truck. The gasoline machines are used only for long-distance work. Mr. S. Fred Smith, local manager of the company, which is one of the Tenney properties, believes that this is one of the first instances in New England, if not in the East, where a central station has made "a clean sweep" of its horse-drawn vehicles and gone over entirely to motor equipment.

Electric Trucks in Industrial Plants

In a paper before the ninety-fifth semi-annual meeting of the National Association of Cotton Manufacturers at Atlantic City, N. J., recently, Mr. Day Baker, New England manager for the General Vehicle Company, pointed out that in a one-story garage, not over 25 ft. by 65 ft. in dimensions, may be housed a complete equipment of five electric trucks, which will displace and perform the work of nine or ten horse-drawn trucks and eighteen to forty horses, depending on the size of the trucks required and the methods of operation. Many special applications of electric trucks can be made to advantage. For example, an electric winch was recently installed on one of the yard trucks of a Lowell textile plant. With this winch freight cars are switched in a shed where steam locomotives and gasoline trucks are prohibited. The winch is also used in loading heavy cases and in shifting cars around the loading platform.

Rapid advance is being made in industrial-truck applications for indoor service. An installation of twenty-five of these is in service on the New York pier of the Fall River Line steamers. The trucks are capable of ascending a 20 per cent grade, and they operate in extremely confined and congested quarters. The operators drive the trucks at three times walking speed, and each carries from two to three times the weight portable on a hand truck. A fleet of ten such trucks is also in use at a print works in Lawrence, Mass., hauling rolls of print cloth from the storehouse to the printing machines and transporting dye tubs between the color room and the machines. One of these trucks in a plant near Montreal is equipped with a hand winch for warping on coils of wire, and one now building is designed to carry fire extinguishers and other

protective apparatus for mill service. In a representative mill an industrial truck carrying two men delivers six full beams of cloth and returns with six empties in eleven minutes, the beams weighing 1902 lb. Fifty-five minutes was formerly required for this work. By the introduction of industrial trucks savings in labor running sometimes as high as 70 per cent are being secured, and the original cost of the truck is soon cared for from the labor appropriation.

A Fan Display on a Moving Truck

The Los Angeles Motor-Truck Club recently held a commercial-vehicle parade, and the Southern California Edison Company was called on for the loan of a number of trucks for use in the procession. Seeing in the opportunity thus afforded a chance of "boosting" the electrical industry, the Edison company hurriedly equipped a truck with a number of large 110-volt direct-current fans, mostly of the oscillating type. The fans were connected to the truck battery,

MOVING FAN DISPLAY ON TRUCK

which consisted of sixty-five Edison cells giving an emf of approximately 80 volts, and they ran well at this low voltage. Colored streamers helped to enliven the appearance of the display, which attracted much attention.

At another time the same idea could be worked out more elaborately. Only three hours were available for installing the fans in the case illustrated so that the display necessarily had to be made simple.

Garage Rates for Customers' Electric Vehicles

In an Eastern city of 80,000 population the central-station company now operates a garage for the convenience of its electric-vehicle patrons. Most of these users charge their batteries on their own premises but bring the cars in to the company's garage occasionally for flushing, overcharging and general battery attention. The pleasure cars average consumptions of 100 kw-hr. per month, returning a central-station income of about $5 per month.

MONTHLY RATES FOR GARAGING CUSTOMERS' ELECTRIC VEHICLES

700-lb. vehicle	$35.00
1,000-lb. vehicle	35.00
2,000-lb. vehicle	37.50
4,000-lb. vehicle	45.00
7,000-lb. vehicle	55.00
10,000-lb. vehicle	60.00
Storage space without care	17.00

The accompanying table shows the schedule of monthly rates charged by the company garage for stabling customers' cars, charging batteries, cleaning and adjusting. These rates do not include renewals or extensive repairs. For a single charge of a pleasure vehicle the rate is $1. For charging, calling for and delivering the rate is $1.25 and for washing $1 extra.

Electric Appliances for Farmers' Wives

The North Dakota Federation of Women's Clubs believes that the women on the farm are entitled to the same advantages as are possessed by the women of the city. By the introduction of labor-saving devices, such as electric flatirons, electric washing machines, electric cream separators and the like, it feels that a decided step will be taken toward making farm life more attractive to the farmer's wife and daughter. The ladies do not appear to be quite sure where the electricity is coming from, but at any rate they are interested in the subject, as shown by the fact that a rural betterment department has been established by the federation to familiarize farmers' wives with these modern improvements. It is said that President Minnie J. Neilson, of Grand Forks, N. D., is enthusiastic over this phase of the federation's work.

Rental of Electric Household Conveniences

A woman in South Bend, Ind., writes to the household department of a Chicago daily newspaper to say that her neighbors expressed so much admiration for her electric flatiron that she conceived the idea of renting it to them. The rate fixed for the use of the iron is 10 cents an hour. This enterprising housewife is also the proud possessor of an electric vacuum cleaner. This she rents out also, charging for its use 15 cents an hour. Thus the neighbors have paid the businesslike owner of these devices enough to reimburse her for the first cost and also supply her with some extra pin money. This plan would seem to be all right from the electric-service company's point of view, but probably is not exactly to the liking of the manufacturers of these devices.

Activity in Indianapolis

Work is well under way for extensive additions to the Mill Street generating station of the Indianapolis Light & Heat Company. The present station is a modern, well-built turbine plant with four vertical Curtis units having a total maximum rating of about 15,000 kw. The addition will house a General Electric horizontal turbo-generator of 12,500 kva, with boilers and accessories. Space will be provided for two additional 15,000-kva units. The big new unit now ordered will be ready for service, it is planned, by July 1, 1914. In the completed station all the generators will be in one room about 250 ft. long, but there will be two distinct boiler rooms.

The Indianapolis company is also installing a large new storage battery, made by the Electric Storage Battery Company, in Substation C, on East Wabash Street. The old battery in the North Meridian Street substation is to be rebuilt. When these improvements are completed there will be a battery reserve on the system capable of supplying 18,000 amp for one hour.

Increasing business makes these plant additions necessary. Indianapolis has two large electric-service companies, the Merchants' Heat & Light Company being the other one. Until recently there were three, but the People's Light & Heat Company has been absorbed by the Merchants' company, unless the action of the Public Service Commission is set aside by the courts. Both the existing companies operate district-heating plants. Indianapolis is wide awake electrically, however, and, despite competition, the Indianapolis Light & Heat Company reports that its kilowatt-hour output has exceeded that of last year every month by from 16 to 20 per cent. It has about 29,000 customers in a city of 233,000 people. It does the city electric street lighting, maintaining about 2300 arc lamps for this purpose. It is an energetic, home-owned company, with progressive policies. Mr. C. C. Perry, its president, has

directed its affairs since 1888. Few electric-service properties in this country have been in charge of the same man for twenty-five years. Mr. Thomas A. Wynne is vice-president and engineer of the company.

The younger company, the Merchants' Heat & Light Company, has been in existence about eleven years. Mr. E. L. McKee is president and Mr. E. Darrow is general manager. It also reports a flourishing and increasing business. It is said to have the largest district-heating system in the world. The district supplied is about 3 miles long and 2 miles wide, and to it is furnished low-pressure exhaust steam from two stations. The station of the former People's company at Sixteenth and Alabama Streets will be shut down electrically, but hot water for heating will be supplied from it, the water being heated by exhaust steam from the Merchants' company's present stations. The Merchants' company, in its electrical department, makes a special effort to obtain the business of large consumers. "We are the company," it says, "that lights the big stores and theaters." Its principal generating station is at West Washington Street and the White River. Mr. Darrow recently announced plans to install an additional 10,000-kw turbo-alternator unit and 4000 hp in water-tube boilers in this station, although it had been previously proposed to build a new plant in the Massachusetts Avenue section.

Central-Station Refrigeration

A neatly printed and attractively illustrated pamphlet entitled "Electric Refrigeration" just issued by the Commonwealth Edison Company of Chicago gives some examples of modern ice and refrigeration plants operated from central-station service. Brief descriptions are given of nine artificial ice factories in Chicago using electrical energy from the central station. The remainder of the book is devoted to electric refrigeration as exemplified in dairies, butcher shops, florists' establishments, storage warehouses, groceries and restaurants; also, water-cooling by electrically driven compressors. The booklet is interesting in affording an idea of the extent to which central-station energy is used in ice-making and refrigeration in one city. It also should be valuable in furthering the extension of electric service for these purposes.

Opening a "White Way" at Mount Vernon, N. Y.

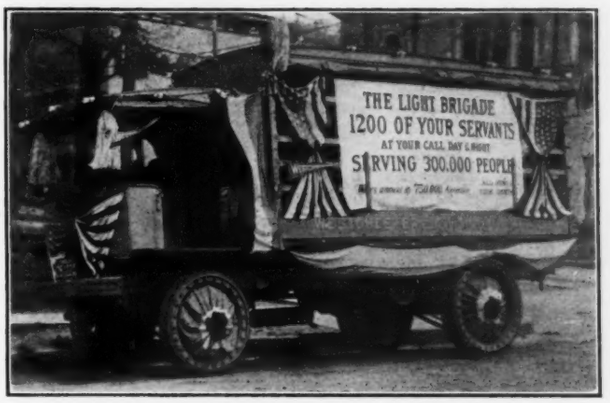
On the evening of Oct. 9 the "white way" lighting installed on Fourth Avenue, Mount Vernon, N. Y., by the Westchester Lighting Company, was officially opened by the mayor of the city. The installation comprises forty four-lamp clusters carried on ornamental iron posts located at 100-ft. intervals. Each post is equipped with four 100-watt multiple tungsten lamps inclosed in 12-in. Alba globes.

The new installation replaces seven 1200-cp arc lamps, each of which consumed 1777 kw-hr. per annum. It is estimated that each tungsten cluster will consume 1000 kw-hr. per annum. Three of the lamps in each cluster will burn from sundown to midnight and are to be paid for by the merchants. The fourth lamp will burn on the regular all-night lighting schedule and is to be paid for by the city.

Preparations for an elaborate celebration had been made by the Westchester Lighting Company, opening at 7 o'clock with an illumination of the company's office building outlined with electric lamps. In addition a powerful searchlight was played over the city from the cupola of the building.

The parade, which began at 8 o'clock, was led by a steam calliope, followed by automobiles containing the officials of the company and citizens. The president of the company rode on horseback. Behind the automobiles came the trucks and wagons of the company from adjoining districts. About 100 vehicles were in line, all gayly decorated. The trucks carried striking signs, a good sample of which is seen in the accompanying picture of the truck from Tarrytown.

The automobiles and floats were followed by the male employees of the company marching four abreast led by a military band. In all there were about 1000 marchers



ELECTRICALLY LIGHTED TRUCK IN PARADE AT MOUNT VERNON, N. Y.

in line, carrying transparencies and company pennants. The rear of the parade was brought up by the company's emergency car, in which was seated a boy dressed as a "buttons" in a white suit. For buttons down the front of his coat he wore a row of small electric lamps which flashed during the progress of the parade.

Many merchants took advantage of the opportunity to do some very creditable advertising, following in the wake of the parade with their decorated wagons.

Commercial Methods at Boston

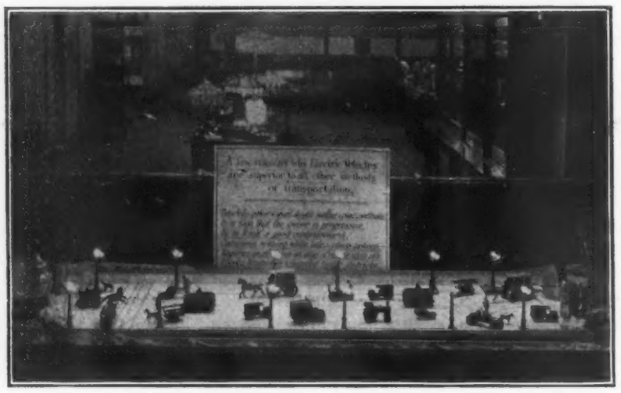
At the recent convention of Edison illuminating companies a paper by Mr. Leavitt L. Edgar recounted one year's activity by the Boston Edison company in promoting the use of energy-consuming devices and the result. The Boston 1912 Electric Show was run at a cost of over $200,000, and although showing a deficit was more than successful from an educational viewpoint. More than 350,000 persons paid admission during the four weeks of the show, which was devoted to varied applications of electricity to domestic and commercial uses. The country-wide attention that the company has brought to the electric vehicle is well known. During the electric-vehicle campaign the company authorized the expenditure of $7,500 by the Massachusetts Institute of Technology to enable it to carry on investigations of various sorts to determine the cost of operating electric vehicles under all kinds of conditions. The recently announced department of investigation inaugurated with an endowment of $100,000 at the college mentioned is admittedly a direct result of the researches carried on by it for the Edison company.

Perhaps the most unusual method of attracting the attention of the public has been the "Farm of Edison Light and Power," a portable equipment containing practically every farming implement and appliance that is made to operate by an electric motor. The "House of Edison Light," built by the company to educate the housekeeper in the use of electricity in the home and moved from place to place in the company's territory, is also another well-known feature of the company's merchandising scheme. During the last year the company entered seriously upon a campaign to promote the use of devices by giving lectures

before gatherings of different kinds. The lecture bureau is supplemented by a corps of demonstrators, and the "May breakfasts" given by suburban churches, as noted at the time in these columns, were in charge of the lecture division. During July the appliance department inaugurated a plan for selling electric ranges on an instalment plan of ten monthly payments of $8, plus the cost of wiring, which is installed by a contractor at a flat price of $33. This campaign is now under way. Last spring another flatiron campaign was started with 3-lb. and 6-lb irons on thirty days' trial. At the end of the time the iron, if kept, was billed at $4.50. These flatiron campaigns have always been successful and the company intends to continue them next year. In addition to the many lines of activity mentioned, the Boston Edison company maintains stores where complete stocks of the latest electrical appliances may be had. The appliance department, which operates three shops, gives free demonstrations at the homes of customers. The company also maintains signs throughout Boston and its suburbs advertising electric service. In addition, it has established thirty-six pay stations for the convenience of customers in paying bills.

An Electric-Vehicle Display Window

In connection with a recent electric-vehicle campaign, Mr. Robert W. Hoy, commercial manager of the Harrisburgh (Pa.) Light & Power Company, arranged a window exhibit which attracted a great deal of attention. Around the edge of the display space was built an oval track with a 3-in. groove, while in the center of this raceway was a miniature model of Market Street, the principal business thoroughfare of Harrisburg, carefully laid out from Mar-



ELECTRIC-VEHICLE WINDOW DISPLAY AT HARRISBURG, PA.

ket Square to Fourth Street, a distance of two blocks. Lines were drawn representing street-car tracks just as they are located on these streets and heavy threads fastened to a percolator at one end and a toaster stove at the other represented trolley wires. Two street cars were shown in operation with their trolley poles making contact with the threads, while in the spaces at the sides vehicles of all descriptions, horse-driven, gasoline and electric trucks, were arrayed in lifelike arrangement. The electric wagons were distinguished by signs on the sides, "Electric Service." Traffic policemen were stationed at three points along the street. One of the principal attractions of the display by night was the miniature ornamental lighting installation, reproducing with fidelity the arc standards recently erected along the curbs of the principal streets in the business section of Harrisburg.

Racing around in the groove circumscribing the window were three celluloid balls, red, white and blue, which were driven by the wind from three 12-in. fans placed at the corners of the track. One ball represented electric vehicles, one the gasoline cars, and the third horse-driven wagons, and there was one point in the oval where it was possible for these balls to pass each other. The white ball, for some unexplained reason, passed the other two very frequently and was therefore named the "electric wagon." In the center of the window a large placard called the attention of the public to the many advantages to be gained by using electric vehicles.

Information for Customers

Much useful information is contained in the new "Customers' Information Book" of the Minneapolis General Electric Company. This is a pamphlet of thirty-two pages bound in a neat paper cover. A copy of it has been mailed to every customer of the company, and one is handed to each new applicant for service. Its purpose is to give customers information that will be useful in the satisfactory employment of electric service.

The company states its purpose thus: "Our desire is to earn the right to reasonable compensation in exchange for a service necessary to Minneapolis and its people, and to earn the wage fairly by honest service pleasantly and cheerfully rendered." This is certainly well put. Customers are told how to obtain service, what the sales department is for, how to adjust service troubles, how to read meters and check bills, and the basis of rates. The customers and the general public are invited to visit the office of the company, one part of which has been fitted up as a customers' lobby with public writing tables, telephones, stationery and comfortable furniture for those wishing to transact business or meet friends.

Prominence is given to the statement that the general manager endeavors to receive personally all who wish to see him. In relation to pulmotors it is announced that a completely equipped machine will be sent at once by automobile in response to all emergency calls, without regard to the cause of the injury to the patient. Another statement of interest is that during warm weather the company will, upon a doctor's certificate, give free electric-fan service to invalids unable to pay for it. This offer, of course, applies only to localities where the company's service is available. In relation to "grief" the company says: "Every complaint lodged with the company is a favor, because we desire our service to be as nearly perfect as ingenuity and unremitting attention can make it." Each service trouble call is followed up by a return post card asking whether the trouble has been remedied satisfactorily. The company does not do wiring, and says that so long as the contractors and supply houses of Minneapolis render efficient service at reasonable prices, as at present, it will continue to co-operate with them in all practicable ways.

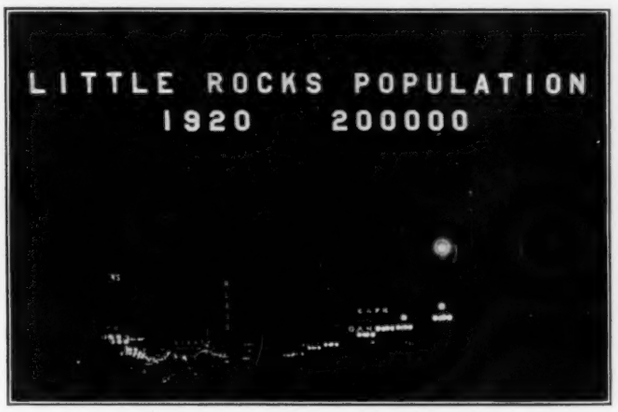
Rate schedules are given fully and an attempt is made to explain the basis of rates. The residential rate is 9 cents per kw-hr. for the first 3 kw-hr. per room per month, and a secondary rate of 6 cents per kw-hr. is made for all additional energy, both subject to a discount of 5 per cent for prompt payment. The minimum bill is fixed at $1 a month. It is noteworthy that in the whole pamphlet the words "rule" and "regulation" are not used except in one instance, where it is stated that every employee is provided with a book of "Safety Rules" and is instructed in first aid to the injured.

H. M. Byllesby & Company control the Minneapolis General Electric Company, and the book was prepared under the direction of Mr. W. H. Hodge, manager of the publicity department of the Byllesby organization. It is the intention ultimately to supply each Byllesby property with a similar book, printed locally, as in the case of the Minneapolis pamphlet.

Illumination and Wiring

Little Rock's Slogan Sign

To the city of Little Rock, Ark., the Little Rock Railway & Electric Company has donated the double-reading electric sign illustrated herewith. The cost of its operation will be defrayed by the local merchants, who have undertaken a subscription collection among the business houses of the main thoroughfares. The slogan sign contains 654 10-watt lamps and is illuminated on both sides. It is mounted on a steel framework between 35-ft. poles. Since the erection of the display a number of merchants have adopted its slogan in their newspaper advertising.

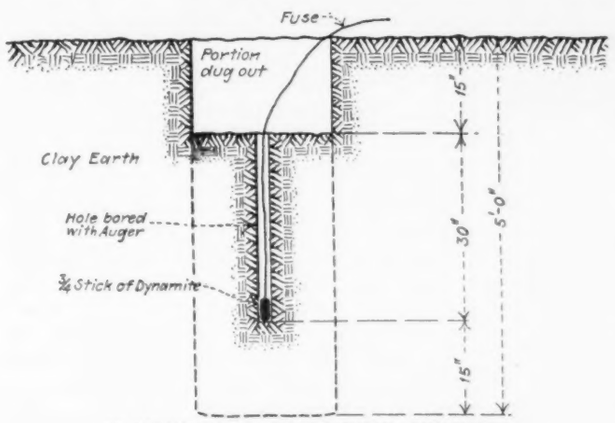


ELECTRIC-LIGHT SLOGAN AT LITTLE ROCK, ARK.

Blasting Holes for Wooden Poles with Dynamite

Nearly every central-station manager north of the Mason and Dixon line has had the unpleasant experience of paying prices ranging upward from $1 apiece for pole holes which had to be dug in frozen ground. The accompanying illustration shows the scheme which was used by the Marion Light & Heating Company, of Marion, Ind., for digging holes when the ground was frozen to a depth of more than 24 in.

The hole was first topped and the earth removed to a depth of from 12 in. to 15 in., care being taken that the top of the hole was in conformity with the size of the finished hole desired. A long-handled auger was then used to bore a hole slightly larger in diameter than a stick of dynamite to a depth of about 27 in. or 30 in. The charge, when placed in this small hole and tamped in and ignited, blew a neat round excavation as large in diameter as the portion which had been dug out at the top. With three-quarters of a stick of dynamite at the depth specified in the illustration, a hole 5 ft. deep was secured in the clay ground at an average saving of 15 to 20 per cent over the cost of manual digging.

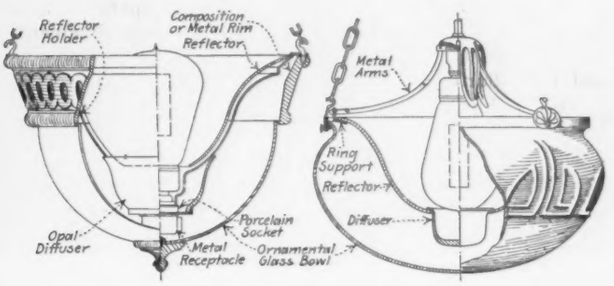


BLASTING POLE HOLES WITH DYNAMITE

Types and Uses of Semi-Indirect Lighting Units

By LEONARD V. JAMES

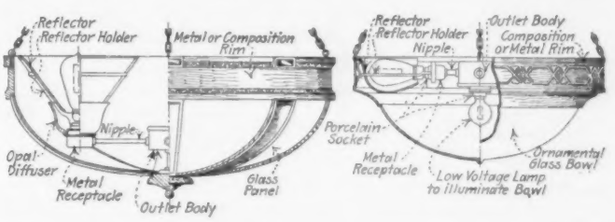
The tendency in modern lighting installations is undoubtedly toward diffused illumination, together with an effort to add to the appearance of the room by the use of proper fixtures. Direct lighting from unshaded sources and indirect lighting with all of the light-flux reflected to the working plane from a diffusing surface are the extremes. Approaching the direct lighting there is the type of unit in which the light source is shielded by shades ranging from nearly clear glassware to translucent bowls and finally to opaque mirrored reflectors, all of these having a more or less directive effect. The so-called semi-indirect system is really a special case of the modified direct, since most of the useful light-flux passes through the translucent bowl.



FIGS. 1 AND 2—LAMPS AND REFLECTORS IN VERTICAL POSITION

The combination of the direct and indirect lighting furnished by the luminous-bowl units is effective and pleasing and meets the public demand for indirect lighting together with an apparent light source. In a paper read before the Illuminating Engineering Society in June, 1912, Mr. Thomas W. Rolph discusses the results of a series of tests, suggesting that the illumination of the ceiling with indirect lighting is from 10 to 15 per cent as intense as that of a direct-lighting fixture producing the same effect in the room. These results seem to have been verified by the manufacturers of the luminous-bowl fixtures under discussion, as the light-flux used in securing the desired effect appears in all cases to be almost exactly 10 per cent.

There are two arrangements of the interior equipment used in the fixtures in question. As a rule the reflectors and lamps are in a vertical position, as shown in Figs. 1, 2 and 3. The reflectors used are one-piece silvered-glass opaque reflectors. The light-flux which illuminates the outside bowl passes through and is directed by an opal diffuser, located so that it interferes but little with the



FIGS. 3 AND 4—LAMPS AND REFLECTORS IN VERTICAL POSITION AND LAMPS AND REFLECTORS IN HORIZONTAL POSITION

normal reflection required for general illumination. Fig. 4 shows the arrangement used when shallow bowl fixtures are employed, it being necessary here to install the lamps and reflectors in a horizontal position. The small lamp which lights the bowl is suspended at the center of the equipment and usually consumes about 10 per cent of the total wattage

FIG. 5—REPRESENTATIVE DESIGN OF FIXTURE IN BEDROOM

of the fixture. Note that in all cases the equipment is suspended from the edge of the fixture.

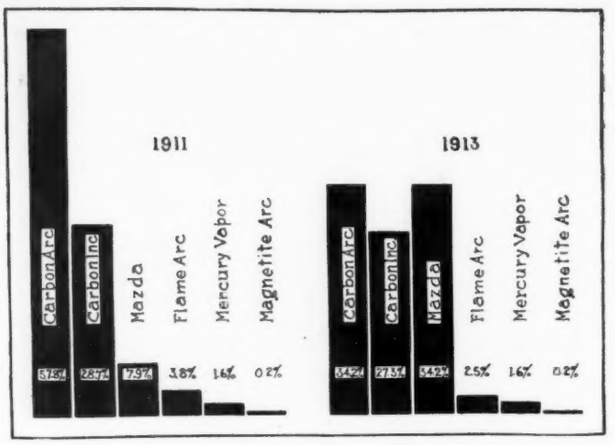
Representative designs of single and multi-unit luminous-bowl fixtures in characteristic installations are shown in Figs. 5 and 6. It is apparent that a very artistic effect can be secured by properly choosing the patterns and colors employed, the color of the bowl being determined either by that of the glass or that of the illuminating bulb. In each case the installations were photographed by the light of the luminous-bowl fixtures alone. Although long time exposures were necessary, it should be noticed that no halation about the bowls is apparent. The light is soft and diffused, but the manner in which the detail is brought out shows that there is plenty of illumination.

FIG. 6—REPRESENTATIVE DESIGN OF FIXTURE IN DINING-ROOM

Cleaning is accomplished in the single-unit fixture by releasing the chain at one of the suspension points. In the multi-unit fixture the reflectors are readily accessible in their normal positions except where horizontal as in the case of the shallow-bowl equipment, where they may be released by a spring catch and tilted into an accessible position. These reflectors have a fire-glazed inner surface so that dust may easily be removed with a damp cloth. Should it be necessary to clean the bowl, it can either be released by set-screws or the entire interior equipment can be lifted clear of the bowl.

Incandescent Lamps in Steel-Mill Service

In the progress report on illumination in steel mills presented before the recent convention of the Association of Iron and Steel Electrical Engineers, New York, data from thirty plants of the sixty-one now in the association were shown in tables and charts. The accompanying illustration is a reproduction of one of the most striking diagrams, and shows the recent revolution in lighting methods. While considerable diversity exists among the various plants in the proportions of different types of units employed, the changes in the past two years are marked and the trend is already apparent toward the elimination of all carbon-arc



LIGHTING EQUIPMENT OF STEEL MILLS

lamps and the substitution of tungsten lamps in their stead. There has also been a slight reduction in the number of carbon incandescent lamps used, but the big difference results from the adoption of the tungsten units to take the place of the obsolete carbon-arc lamps. The fact that carbon-filament incandescent lamps are not going out of service more rapidly is perhaps due to the lack of sufficiently high intensities of illumination, since experience has shown that with a proper system of general lighting carbon drop lamps may be done away with and more satisfactory results secured with no increase in total energy consumption.

Recent Telephone Patents

It has been felt by Mr. H. S. Brewington, of Baltimore, Md., that no register for telephone messages would be satisfactory to all concerned unless visible to the subscriber and at the same time operated only under the joint control of the subscriber and the exchange operator. Mr. Brewington has provided a register accordingly, the register being mounted at the telephone station with the dials in view. When it is time to register the operator effects the count with the assistance of the subscriber.

Granular carbon is used in considerable quantity in the manufacture of transmitters, and for the best results it should be of uniform texture. It is with a view of producing better carbon that Mr. J. C. Lee, of Brookline, Mass., has invented an electric oven for treating the granules. The carbon particles are required to pass through a contracted throat, at either end of which an electric terminal is placed. The baking is effected by electrical energy.

Letter to the Editors

Some Phase-Transforming Systems

To the Editors of the Electrical World:

SIRS:—Referring to the letter from Mr. Rudolph W. Van Norden in your issue dated Oct. 18, 1913, attention should be called to the fact that in 1892 Prof. R. Eron disclosed the three-phase to two-phase method referred to by Mr. Van Norden by the use of two single-phase units as shown in Fig. 1. Long prior to obtaining a patent on the single-unit three-phase to two-phase transformation, I had in my possession a book of notes and sketches in which is given the method, dating back to 1892, which was used in Italy during that period, the notes showing a *one-unit*, three-phase to two-phase method of accomplishing the same results. This book, which I still have, contains many kinds of unusual polyphase systems and wiring schemes.

The patent in question covered not only the means but the method adopted with the one-unit transformation, and not the three-unit method of three-phase to two-phase transformation referred to by Mr. Van Norden. Application was made for a patent on the one-unit method of three-phase to two-phase transformation only after the writer had been repeatedly advised to do so by friends with whom he had discussed the subject, and after the advantages of the method over all other methods, from the viewpoint of lowest first cost of manufacture and ability

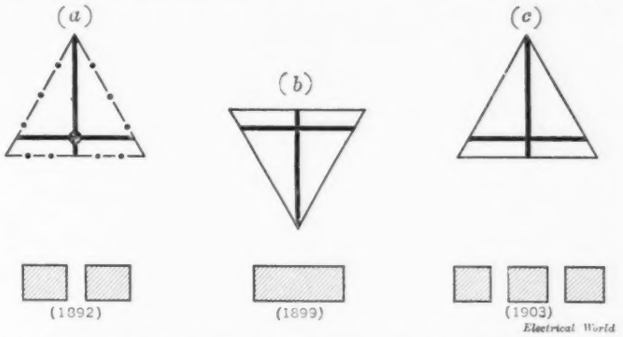


FIG. 1—THREE-PHASE TO TWO-PHASE TRANSFORMATION, SHOWING METHODS USED AND EARLIEST KNOWN DATES

to maintain balanced phase-currents, had been established in practical operation.

In Fig. 1, *a* shows the use of two single-phase units for the three-phase to two-phase transformation, dating back to 1892; *b* shows the use of one three-phase unit for the three-phase to two-phase transformation, dating back to 1899, and *c* shows the use of three single-phase units for the three-phase to two-phase transformation employed by Mr. Van Norden in 1903.

Having become familiar with the original notes given in Professor Eron's book, the present writer devoted considerable study to the internal characteristics of the one-unit method of three-phase to two-phase transformation before the year 1900, but did not consider a patent worth while until certain circumstances arose in the year 1906.

In writing the letter on this subject printed in the issue of the *Electrical World* for Sept. 27 it was the writer's intention to mention two other systems covering all the previously mentioned systems of three-phase to two-phase transformation. It will, of course, be understood that Fig. 4*b* of the earlier letter will cover all of the systems noted with the exception of Fig. 1*a* and that Figs. 2*a*, 2*b* and 2*c* cannot be made to cover any three-phase to two-phase system other than their own—that is, *a* cannot be substituted for *b* or *c*, *b* for *a* or *c*, or *c* for *a* or *b*, a special tap being required for *a*.

For reliability of operation the two systems presented herein (Fig. 2 and Fig. 3) for the transformation of three-phase to two-phase currents require three single-phase transformers, though two single-phase transformers will suffice. In the case of Fig. 3 two transformers will deliver the same phase-angle results as would the three single-phase transformers.

In both Fig. 2 and Fig. 3 one-half of the winding of each unit is connected differently from the ordinary delta.

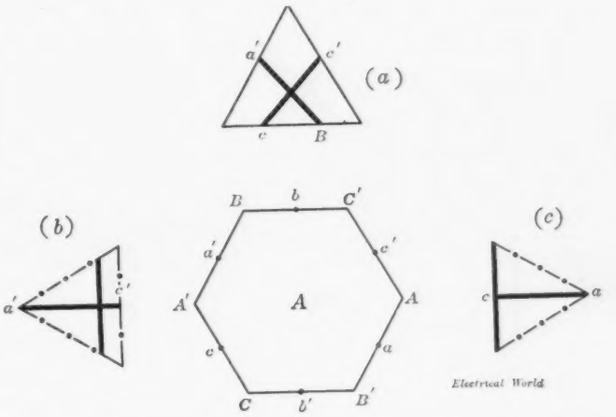


FIG. 2—COMPOSITE METHODS OF OBTAINING THREE-PHASE TO TWO-PHASE TRANSFORMATIONS

In Fig. 2, *A* shows the three-unit method, the other systems being shown at *a*, *b* and *c*, which are self-explanatory. Fig. 3 shows a method in which are two of the three units, half of the respective windings being divided. One of these units can be omitted from the system if need be and three-phase to two-phase operation continued, as at *A' A''*.

It is clear from Fig. 2 and Fig. 3 that all of the systems described in the issue of Sept. 27 are covered by the two methods shown here, and that it is possible to operate them as indicated. Hence, no matter what may be the detailed make-up of each of the methods shown in the issue of Sept. 27, one or the other or both of these methods (depending on the requirement and the system for the one or the other of the two methods) may be substituted for any or all of them, yet the methods themselves (in their make-up) are quite unlike any of those noted previously.

In so far as concerns the recording of notes and sketches of the methods shown in Fig. 2 and Fig. 3, I have in the past sent from abroad to transformer manufacturers in the United States notes taken from my notebook. However, this is the first time these methods, with a particular view to three-phase to two-phase application, have been published. Other methods and means have been experimented

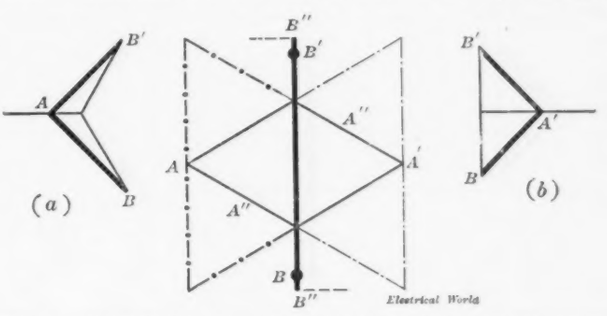


FIG. 3—COMPOSITE METHODS OF OBTAINING THREE-PHASE TO TWO-PHASE TRANSFORMATIONS

with, but those of Fig. 2 and Fig. 3 are the best of the ones dispensing with transformer winding taps other than the common center or 50 per cent tap. In one unit of Fig. 3, *B'*, *B''*, the taps used constitute those of the three-phase to two-phase relations of Fig. 4*b*, shown in the letter in the issue dated Sept. 27.

New York, N. Y. WILLIAM T. TAYLOR.

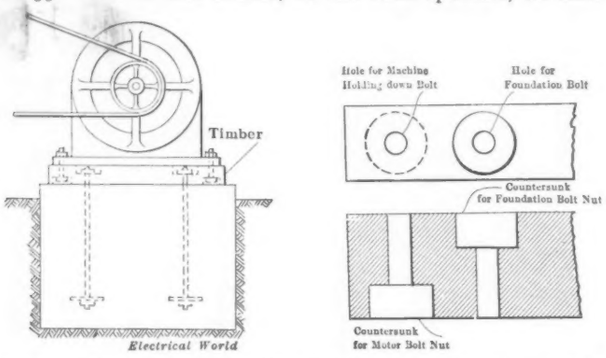
Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Insulating and Grounding Motors and Generators. I

BY TERRELL CROFT

The National Electrical Code specifies that motors and generators operating at pressures in excess of 550 volts must have their base frames permanently and effectively grounded. Motors and generators operating at pressures of 550 volts or less should, so the code specifies, be insulated from the ground wherever feasible, but where the insulation of the frame is impracticable permission may be secured from the local inspection department to omit the frame insulation. However, where such insulation is omitted the frame must be thoroughly grounded.



FIGS. 1 AND 2—MOTOR INSULATED ON A PARALLEL TIMBER BASE AND ARRANGEMENT OF BOLT HOLES IN INSULATING TIMBERS

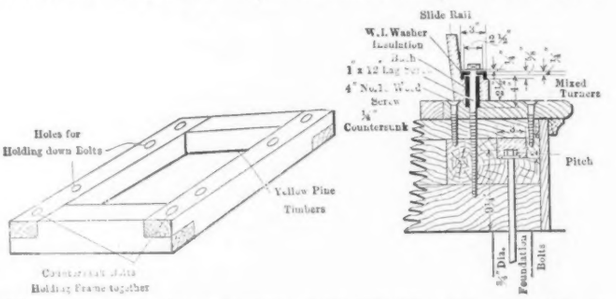
Insulating the frame of a high-voltage machine from the ground introduces a dangerous life hazard, because there may be a leak between the winding and the frame and the attendant touching such a frame can be severely shocked, or possibly killed. Where the voltage is low—below possibly 550—this element of life hazard is not of great moment. It is therefore evident that the frames of all high-voltage machines should be thoroughly grounded, and it is also very likely true that it would be well to ground the frames of all low-voltage machines to protect the attendants from shock.

There is another good reason why it is preferable from the operator's standpoint to ground the frames of all electrical machinery. Consider the case of a frame of a machine insulated from the ground: If a leak occurred in this machine between one of the windings and the frame, the operator would not, in the ordinary course of operation, be advised of its presence, and another ground might occur in the same machine between the winding and the frame, which would make a short-circuit and possibly burn out the machine and produce a fire. If, however, the frame of the machine were thoroughly grounded, a leak between the frame and the winding would make itself known through an indication on the station ground detector, and then it could be readily corrected before another ground could occur and make serious trouble.

The intention of the code rule appears to be that if a frame is insulated it must be thoroughly insulated, and if grounded, thoroughly grounded. If a frame were, however, but imperfectly insulated, sufficient current might, under certain conditions, flow through the high-resistance path constituted by the imperfect insulation and cause a fire. Although the code does not so specify, it is probable that it is always best to ground effectively electrical machinery frames wherever possible, but where effective grounding is not feasible the frame should be thoroughly insulated for the reason just indicated.

It does not appear to be general practice among Underwriters' inspectors rigidly to enforce the code requirement for thorough insulation. Some inspectors appear to pay but little attention to the rule where the pressure is below 550 volts. Where the pressure is in excess of 550 volts, however, thorough grounding is generally insisted upon. Inasmuch as the majority of modern electrical generators are directly connected to their prime movers and are thereby thoroughly grounded through the piping systems serving the prime movers, it is not often that a large generator is not well grounded. Belted motors are frequently insulated owing to being supported on timbers of either a wooden floor or a ceiling. Large motors are usually mounted on a concrete foundation or on the frame of some machine, and in such cases should be thoroughly grounded. Frequently small motors are mounted on the frames of machine tools, and in some cases on small concrete foundations, and hence are not thoroughly insulated, nor can they be said to be thoroughly grounded. In such applications the inspectors appear to ignore the ruling requiring effective insulation or grounding and pass such machines by without comment.

The most common method of insulating generators and motors is by supporting them on wooden timbers. The wooden-base frames used for this purpose should be thoroughly filled and varnished. Almost any sort of wood will do. Where a wooden floor or ceiling is depended on for insulation it should be thoroughly filled and varnished to prevent the entrance of moisture, although it is not often that such precautions are taken in actual practice. A typical installation of a belted unit insulated on timbers is shown in Fig. 1. The timbers are held to the concrete foundation with long foundation bolts, and additional bolts secure the machine frame, or the slide rails, to the timbers.



FIGS. 3 AND 4—INSULATING BASE FRAME AND METHOD OF INSULATING SLIDE RAIL

It is essential that the foundation bolts and the bolts that fasten the machine be well insulated from each other. Fig. 2 shows the arrangement of the bolt holes in the ends of timbers like those shown in Fig. 1, indicating that a sufficient section of wood must be provided between the two holes to obtain adequate insulation. This section in no case should be less than 1 in., and a greater separation is

preferable. As indicated in Fig. 2, it is necessary to countersink the holes for all of the bolts so that the bolt head or the nut, as the case may be, rests well below the surface of the timber. If such holes are not countersunk, the metal of the bolt may come in contact with either the foundation top or the machine frame and defeat the purpose for which the insulating timber is employed.

Another type of insulating base frame that is frequently used, which consists of four sticks held together at their ends by "half-and-half" joints, is shown in Fig. 3. Although base frames of this form are more popular than those like that indicated in Fig. 1, they are not as desirable because dirt and oil are apt to accumulate in the box-like cavity formed by the four timbers. It is often very difficult to remove such débris. With the arrangement of Fig. 1, however, the dirt can be pushed out from the machine frame at either end, and the floor or foundation under the machine can be kept clean with little difficulty. If dirt is allowed to accumulate, it may defeat the purpose for which the timbers were placed, because the timbers may become impregnated with it, which will reduce their insulating qualities.

The insulating frame that was installed under a large low-voltage belted alternator is shown in Fig. 5. For this application an extremely heavy timber frame was required because of the size of the machine, which was almost 11 ft. long. After the 10-in. by 10-in. sticks composing the sills for the frame were in place and held down with the foundation bolts, a double floor of 2-in. by 2-in. wood planks was nailed to the sills, and on this floor the generator was supported, the slide rails for it being held down

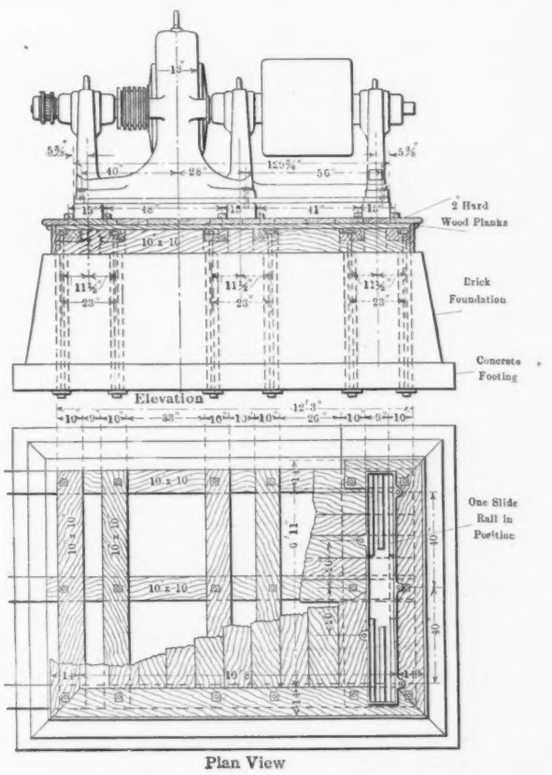


FIG. 5—INSULATING BASE FOR A LOW-VOLTAGE GENERATOR

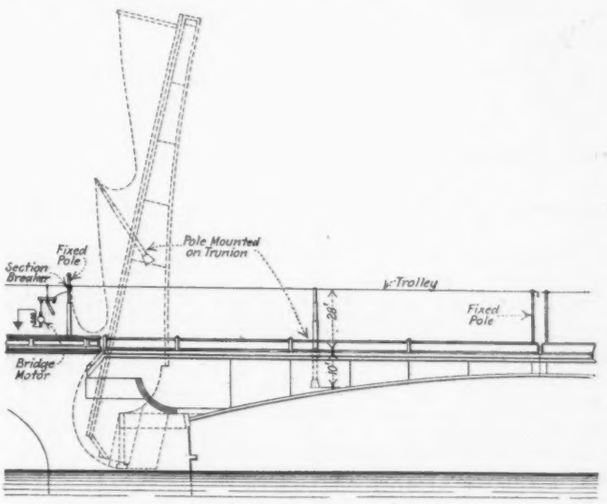
with lag screws turning through the floor and down into the sills.

There are often cases where Underwriters' inspectors have insisted that the lag screws holding the slide rails of the machine to the wooden-base frame be thoroughly insulated from the slide rails. The arrangement that has been used in such cases is shown in Fig. 4. The insulating washers and bushings were turned from fiber. The wrought-iron washer should always be placed on top of the fiber washer, as suggested in the picture, to prevent the head of the lag screw from digging into the fiber. In the installation illustrated the countersunk holes in which the nuts on the ends of the foundation bolts turn were filled with pitch to insure further protection.

Various other ways of insulating motors and generators as well as effective methods of grounding the frames of electrical machines will be described in a subsequent issue.

Trolley-Wire Slack Take-Up for Lift Bridge

A novel arrangement for taking up slack in the trolley wire when the bascule span is raised is in successful use on the new Cherry Street bridge at Toledo, Ohio. In the design of this structure no towers or overhead construction



ARRANGEMENT FOR TAKING UP TROLLEY-WIRE SLACK FOR LIFT BRIDGE

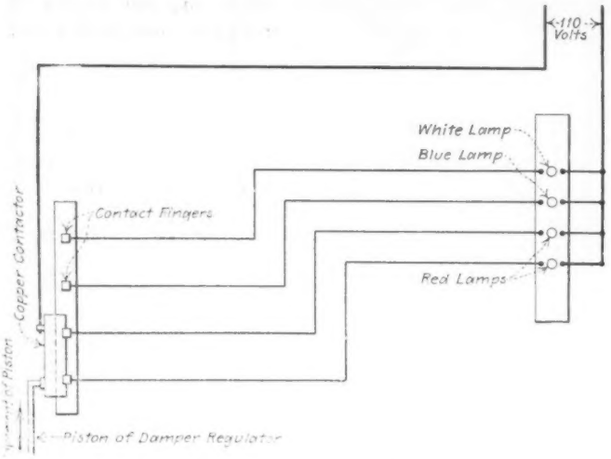
was permitted, so that the usual trolley retractor equipment had to be abandoned. The problem of drawing up slack in the wire was, however, successfully met by providing pivoted trolley poles at the center of each span, each of these poles having its lower end loaded with a weight sufficient to hold it in a vertical position regardless of the angle at which the bridge-leaf stands. In this way the slack accumulated ahead and behind the pivoted pole is divided equally on both sides, keeping the wire always clear of the rail.

As shown in the sketch, the weighted center poles are carried on heavy trunnions, which permit the member to maintain its upright position independent of the bridge position. These poles stand 28 ft. above the roadway, and the weighted portion extends 10 ft. below the trunnion mounting. For the bridge section, No. 4/0 flexible hard-drawn stranded wire is used as the trolley conductor. This bridge section is separated from the main line by an insulating breaker, and receives its energy through one position of a double-throw switch, the other side of which supplies the bridge motor. To operate the bridge, therefore, this switch must first be thrown, thus automatically disconnecting the trolley wire before the lift motor can be started or the bridge moved.

The Cherry Street bridge has been in continuous operation since early spring, being lifted fifteen or twenty times a day, and according to Mr. W. E. Richards, superintendent of the electrical department of the Toledo Railways & Light Company, which made the installation, it has developed absolutely no faults whatever in this long period of practical use.

Boiler-Room Damper Signal

For obvious reasons, stokers have trouble in seeing the position of the damper after looking at the blazing fire, and in order to offset this difficulty Mr. William F. Thompson, engineer of the station of the Marion (Ind.) Light & Heating Company, has installed in the boiler roof of the plant



SCHEME FOR SHOWING DAMPER POSITION BY MEANS OF LAMPS

an arrangement such as is shown in the accompanying sketch.

Attached to the top of the piston of the automatic damper regulator is a copper contactor which is connected to one side of a 110-volt circuit. To the other leg of the circuit are connected four lamps, and as the piston of the automatic damper regulator moves up and down the lamps are lighted and extinguished. The two red lamps at the bottom are lighted when the damper is nearly closed. As the half-open position is approached the blue lamp is lighted, and at full damper opening the white lamp is switched into the circuit. The return of the piston to the closed damper position extinguishes the upper lamps.

As the damper-regulator piston follows the variations of the steam pressure the lamps also give an indication as to the condition of the fires to one who is familiar with the operation of the plant.

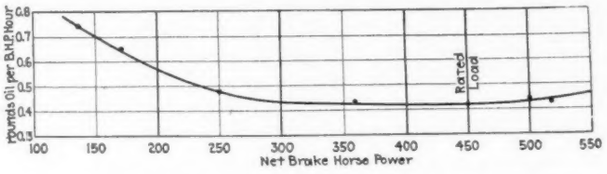
Fuel Consumption of 450-hp Diesel-Type Engine

In the accompanying table and curve there are presented results of tests recently made on a 450-hp Atlas-

RESULTS OF TEST OF 450-HP DIESEL-TYPE ENGINE

	HOURS EACH TEST						
	2	1	3	2	4	1	1
Approximate per cent of rating	25%	33%	50%	75%	100%	110%	115%
Net brake-hp load	131	165	247	355	459	498	525
Total oil per hour, lb	92	110	121	154	196	218	225
Oil per brake-hp-hr., lb	.703	.667	.49	.433	.427	.44	.43
Oil per indicated-hp-hour, lb	.316	.334	.30	.300	.318	.332	.33
Mean effective pressure for each cylinder, lb. per sq. in.:							
Cylinder 1	40	45	55	72	84	93	96
Cylinder 2	41	47	56	73	87	91	97.5
Cylinder 3	40	45	58	73	90	95	97
Average mean effective pressure, lb	40.3	45.7	56.3	72.7	87	93	96.8
Indicated hp	291	329	403	518	615	656	682.4
Mechanical efficiency, per cent	45	50	67.5	68.5	74.6	76	77
Friction and compressor losses	160	164	156	163	156	158	157.4
Revolutions per minute	184	183	182	181.5	180	179	179
Gal. oil per 100 brake-hp-hours	9.63	9.1	6.72	5.93	5.85	6.03	6.00
Net thermal efficiency, per cent	18.9	19.9	27.1	30.7	31.1	30.2	30.9

Diesel engine purchased by Messrs. L. L. & P. N. Nunn, of Provo, Utah. Seven different runs are recorded of one to four hours' duration at various loads. The results show that the fuel efficiency reached a maximum at full-load rating when the consumption per brake-hp-hour reached 0.427 lb. of oil. The fuel used weighed 7.29 lb. per gallon, and on the Baumé scale showed a specific gravity of 30 deg. It had a fuel value of 19,150 lb.-Fahr. heat units per pound. In addition to pointing out the sustained high efficiency of the engine over a wide range around full-load rating, the results also show the overload possibilities of this internal-combustion unit. The test was made in the



FUEL-CONSUMPTION CURVE OF 450-HP DIESEL ENGINE

shops of the builder, the Lyons-Atlas Company, Indianapolis, Ind. At full load the mechanical efficiency of the engine was about 75 per cent, and its net thermal efficiency reached 31.1 per cent.

Operation of Surge Indicator

Please describe the surge indicator for transmission lines and explain the principle of its operation. G. O. A.

Indication and record of the occurrence of surges in transmission systems can be obtained by means of so-called "surge indicators" tapped onto the phase wires of the line affected. This surge indicator consists of an adjustable horn-gap which is connected in series with a resistor formed of a long tube filled with water and having one end grounded. The gaps are set for values in excess of the normal line pressure, so that in case of a voltage surge the increased potential will break down the gap and discharge to ground through the high resistance. A circular chart, prepared with chemicals to render it fireproof, is revolved by clockwork between the points of the spark-gap so that the passage of any spark discharge burns a hole in the paper, thereby recording the exact time at which the surge has taken place.

The Gas-Ignition Hazard of Incandescent Lamps

Are there any cases on record where the accidental breaking of globes of burning incandescent lamps has ignited explosive mixtures of gas. If so, how serious is this hazard? L. S. B.

The ignition of mine gases by incandescent lamps was the subject of an elaborate investigation recently carried out by Messrs. H. H. Clark and L. C. Ilsley and reported by them to the United States Bureau of Mines. They found that if through such cause as breaking of the tip or globe an explosive mixture of gas can reach the filament, without breaking the latter or producing partial combustion within the globe, ignition is sure to occur. Certain standard lamps which do not usually ignite mixtures when smashed will do so if the broken pieces of the filament cause a short-circuit when the globe is smashed. The authors believe, however, that the matter of ignition is a function of filament diameter, the larger filaments producing ignition in the majority of cases. Instances have been observed with miniature lamps where the filament continued burning intact several seconds after ignition had taken place, showing conclusively that ignition was not due to the arc or spark following fracture of the filament. When a glowing incandescent globe is smashed, the inrushing gases first cool and then break the filament. Ignition takes place, it is believed, during the cooling period, but before the filament has been broken.

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Reluctivity of Silicon Steel.—J. D. BALL.—An article illustrated by numerous diagrams. The curves usually drawn to represent the magnetic properties of a material are of such a nature that they are not easily determined throughout from the observed data, do not show simple mathematical relationship, do not detect small errors or show reliability of test, do not permit of satisfactory extrapolation, and cause considerable difficulty in determining from them the magnetizing force for high inductions. This article deals with the reluctivity, or reciprocal of the permeability, which over a wide range is a linear function of the magnetizing force, a fact often neglected. Accordingly, curves may be drawn which are most satisfactory from all standpoints and from which costs may be derived. Sample curves, tables and equations for silicon steels are given, including the average values obtained for 2.5 per cent and 3.5 per cent silicon content, these materials being widely employed at present.—*Gen. Elec. Review,* October, 1913.

A 20,000-kva Turbo-Generator.—This is an illustrated description of a turbo-generator rated at 20,000 kva in operation in the Chorzow power plant of the Upper Silesian Electricity Works, with brief data on the condenser equipment.—*Elek. Zeit.,* Oct. 2, 1913.

Power-Factor Limitations of Rotary Converters.—J. L. MCK. YARDLEY.—An article, illustrated by diagrams, which emphasizes the importance of the variation in the currents flowing in the different parts of the armature winding of a rotary converter. Curves are given which explain why it is that careless or indifferent operation of converters without reference to power-factor conditions has sometimes resulted in "roasting" out armature coils. The importance of the tap coil is emphasized. The author also points out the desirability of adjusting a rotary converter to give 100 per cent power-factor at full load rather than at half load. He further commends the present practice of securing the desired compounding by using moderate amounts of both series field and reactance rather than by using a greater amount of series field and a smaller amount of reactance. These two points are of particular importance in connection with rotary converters carrying heavy momentary overloads of 100 or 200 per cent, where the effect of the wattless component introduced by the series-field ampere-turns upon the tap-coil temperature must be seriously considered.—*Elec. Journal,* September, 1913.

Lamps and Lighting

Metallic-Filament Lamp Prices in Great Britain.—Notes on a general reduction in the price of all types of metallic-filament lamps in Great Britain at the end of September. The decision appears to be the outcome of the deliberations of the Tungsten Lamp Association. "No surprise need be expressed at the currency of rumors as to the coincidence of this announcement with that regarding the early introduction of a half-watt lamp. The statements made in the various advertisements to the effect that improvements in manufacture and the increasing public demand have merited the lowering of the prices of the lamps are not taken seriously in all parts of the trade. The assumption seems to be that there are changes in design and construction pending, but before these can be generally effected the stocks of the present types of metal lamp must be gradually cleared. What may be looked for afterward the wiseacres do not tell us, but no doubt, they say, this step is the first toward a practical half-watt lamp."—London *Electrician,* Sept. 26, 1913.

Electric Arc as Standard of Light.—J. F. FORREST.—His complete British association paper, with numerous illustrations, which has already been abstracted in the *Electrical World.*—London *Electrician,* Sept. 26, 1913.

Half-Frosted Lamps in Reflectors.—W. T. MACCALL.—An illustrated account of experiments made on the effect of frosting on lamps used with reflectors. Half-frosting reduces the light by about 10 per cent but considerably increases the vertical candle-power. The light absorbed by the reflectors was calculated from the results of the tests. For the opal shade this absorption is 16 per cent for the clear bulb and 17 per cent for the half-frosted one. For the holophane reflector the amount is 13 per cent in both cases.—London *Electrician,* Oct. 3, 1913.

Ductile Tungsten.—A note on a recent British patent (No. 13,282, 1912) of P. Schwarzkopf and S. Burgstaller. The object of the invention is to produce a mass of tungsten, molybdenum, etc., with uniformly small crystals, suitable for drawing into wires for metal-filament lamps. The process consists in the reduction of the oxides of the metals by carbon after they have been consolidated by pressure in molds. These oxides should be in the form of a fine-grain powder, each particle of which contains a lower proportion of oxygen than the lowest oxide of the particular metal. Sintering and reduction are both effected at the same time by the use of an adjustable current of hydrogen. The rate of removal of the oxygen, in order to regulate the size of the crystals produced, is effected by the addition of an adjustable quantity of an indifferent gas so that the partial pressure of the oxygen is regulated. At the same time the rate of flow of the reducing gas and the rate of travel of the pressed material, as well as the temperature itself, may all be regulated. Furthermore, a metal or compound which is not decomposed at the temperature to which the finished body is to be submitted may be added to the pressed material. The action of the added metal (uranium is suggested) is to lower the vapor pressure without substantially lowering the melting point of the main metal.—London *Elec. Eng'ing,* Oct. 9, 1913.

Graphitized Carbon Filaments.—A note on a recent British patent (No. 27,433, 1912) of the British Thomson-Houston Company and the American General Electric Company. Raw-carbon filaments are impregnated with a boron solution (1 per cent solution of sodium borate), then carbonized, and finally graphitized.—London *Elec. Eng'ing,* Oct. 2, 1913.

Electric-Arc Versus Gas Lighting.—An account of results of comparative tests with electric-arc lamps and high-pressure gas units in a section of the city of Strassburg, Germany. Two classes of open-type flame-arc lamp with superposed flame carbons were operated on a 50-cycle, single-phase circuit, in competition with high-pressure and low-pressure inverted-mantle gas lamps. The results of the tests show that with the usual prices for gas and electricity the arc lamp is much cheaper than the gas lamp and, moreover, gives a much more uniform illumination. As a re-

sult of the tests the city authorities have decided in favor of electric lighting.—London *Elec. Review*, Oct. 10, 1913.

Public-Square Illumination.—A. Kastalski.—An illustrated description of the arc-lamp installation of the Plaza in front of the new union railroad station at Leipzig, Germany. There are sixty 12-amp direct-current flame-arc lamps connected in series groups of four lamps each to the 220-volt system. The poles also serve as the suspension wires of the trolley lines. Directly in front of the station artistic reinforced concrete poles are used. The switching apparatus is placed in underground chambers.—*Elek. Zeit.*, Oct. 9, 1913.

Generation, Transmission and Distribution

Steam Turbine.—An illustrated description of the Ljungstrom radial-flow steam turbine.—London *Elec. Review*, Oct. 10, 1913.

Grounded-Star Versus Isolated-Delta Systems, Viewed from Experience in the Southwest.—C. W. Rice and S. Thomson.—The substance of this paper is to the effect that for extended networks of low power concentration the advantages, from the standpoint of continuity of service are virtually all in favor of the dead-grounded neutral. Grounding the neutral relieves the system from dangerous potentials to earth resulting from grounds on the line, and as a rule such systems are not subject to the damaging effects of the high-frequency disturbances that accompany an arcing ground on an isolated system. Furthermore, a fault is more readily located on a grounded system, while both systems admit of operating the transformers in open delta, or the equivalent, in cases of emergency.—*Gen. Elec. Review*, October, 1913.

Corona Losses.—Weidig and Jaensch.—English translations in abstract of their recent German paper and report on corona phenomena and corona losses in transmission lines.—London *Electrician*, Oct. 10, 1913.

Traction

Limitations of the Capacity of Rapid-Transit Railways in Cities.—Brugsch and Briske.—The authors discuss in detail the limitations of the possibilities of electric roads in cities with trains running in rapid succession in opposite directions, where the line is without side branches but is protected by automatic block signals. The intervals required for starting and stopping trains are given, and in conclusion the authors present the accompanying table, which shows the maximum capacity of electric railways in cities with the lengths of trains varying from 60 m to 150 m (from 197 ft. to 492 ft.).—*Elek. Kraftbetr. u. Bahnen*, Sept. 24, 1913.

DATA ON ELECTRIC RAILWAYS IN CITIES

	Length of Trains			
	60 Meters	90 Meters	120 Meters	150 Meters
Intervals between trains, seconds	49	55	60	65
Trains per hour in either direction	73	65	60	55
Passengers per hour in either direction	29,000	39,000	48,000	55,000

Direct-Current Traction at 1200 Volts.—H. J. Mulder.—The author gives an account of the troubles experienced in the early operation of a 1200-volt direct-current railway line. One of the first surprises met with was the fact that no commercial switching apparatus for 1200-volt direct current was available and that 1000-volt apparatus, while satisfactory up to 1050 volts or 1100 volts, failed completely at 1200 volts. It was, therefore, necessary to use commercial switching apparatus intended for high-tension alternating-current work. The difference between the behavior of such apparatus on direct current and alternating current is pointed out. Another and greater difficulty was in the choice of proper insulating materials. Great emphasis is laid on porcelain insulation. Marble is not satisfactory. Problems of line insulation are also discussed. It is finally stated that in practice the operation at 1200 volts has been found to be no more dangerous than at the usual low voltages, so that the use of pressures of 1000 to 1200 volts within cities is quite possible.—*Elek. Zeit.*, Oct. 9, 1913.

Split-Phase Locomotive.—E. F. W. Alexanderson.—A concise illustrated discussion of the subject with reference to motor design, early tests, theory of phase converter, compensation for power-factor, and features of control.—*Gen. Elec. Review*, October, 1913.

Units, Measurements and Instruments

Speed Meter.—An illustrated description of a speed meter made by the Siemens & Halske company for automobiles. A rotating magnetic field exerts on a movable armature a torque which corresponds to the speed of rotation of the field. As shown in Fig. 1, a permanent magnet,

FIG. 1—SPEED METER FOR AUTOMOBILES

made in the form of a ring with a narrow air-gap, is surrounded by an iron frame. In the narrow space between the frame and the magnet is an armature of conducting material also in the form of a ring. The magnet is driven by gearing from the axle of the automobile. The rotating magnetic field tends to rotate the armature in the same direction, but as there is provided the counteracting force of a torsion spring the armature can revolve only through a certain angle which depends on the speed of rotation of the magnet. The angle of deflection of the armature is then indicated by the needle on the dial. The application of the same principle to a speedmeter for locomotives is also described.—*Mitteil., Siemens & Halske*, September, 1913.

Errors in Magnetic Tests Due to Elastic Strain.—A. Campbell and H. C. Booth.—An abstract of a (British) Physical Society paper. In the course of magnetic tests of sheet material considerable errors are sometimes introduced by even slight bending of the sheets or strips. In a careful investigation of this matter by the authors two methods were used. In method A a single length of strip which was flat in the unstrained condition was bent into ring form, care being taken to avoid permanent set as much as possible. The slightly overlapping ends were securely clamped, and the ring was evenly wound with secondary and primary coils. These windings were of thin wire arranged close to the strip so as to keep the ring as flexible as possible. While in this condition of temporary strain,

the ring was tested for permeability and hysteresis by the ballistic method. The greater part of the temporary strain was then annulled by changing the circular form into a square shape by sharp bends at four places. The windings were not removed for this alteration. The ballistic tests were then repeated. The changes observed were considerable. In method B two strips of the material, with

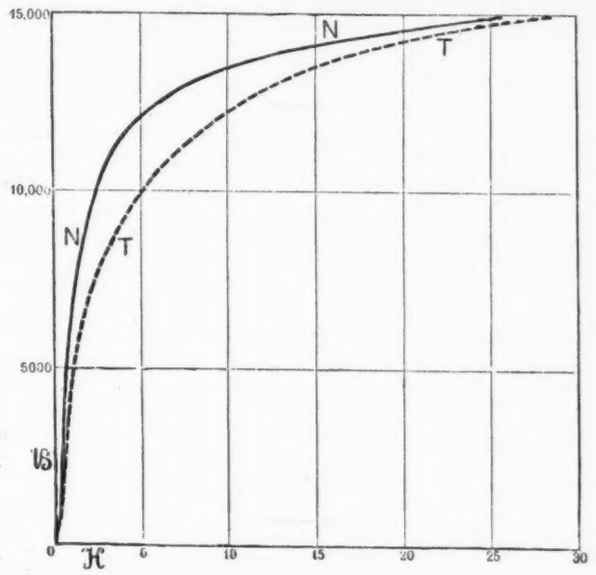


FIG. 2—CURVES SHOWING PERMEABILITY OF SILICON IRON, RING METHOD

suitable uniform windings, were clamped flatwise at the ends of two solid yokes, forming with them a long rectangular magnetic circuit. This circuit could be tested with the strips flat or bent to any desired amount. Permanent set at various curvatures could be applied, and the strips could

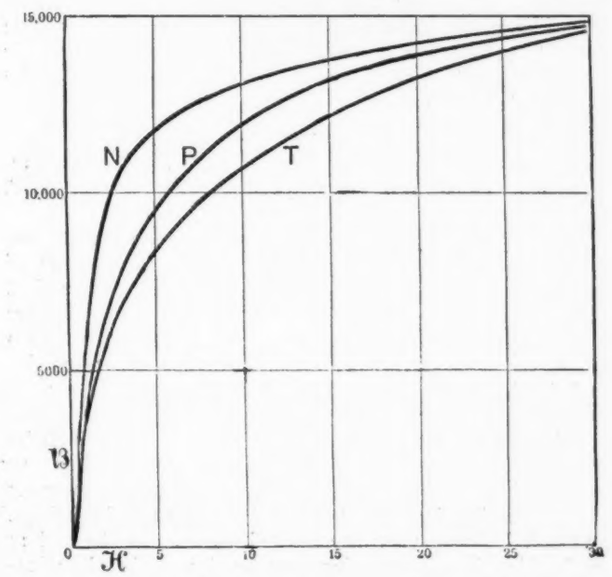


FIG. 3—CURVES SHOWING PERMEABILITY OF SILICON IRON, YOKE METHOD

be restored to their original flat form after any of the bending processes. The results for permeability of silicon iron are shown in Figs. 2 and 3, the former giving results for the ring method and the latter for the yoke method. The curves are marked in each case as follows: *N*, no strain; *T*, temporary strain; *P*, equal permanent strain. The first illustration refers to the ring method, and the second to the yoke method. In the latter method, after the effects of temporary strain had been tested, the strips were allowed to unbend back to the straight condition. When re-tested they gave practically the same results, both for permeability and hysteresis, as in the original unstrained condition. This interesting fact is not indicated in the diagram. It will be seen from that figure that the temporary strain has considerably greater effect on the permeability and the hysteresis than the equal permanent strain has. This is an example in which the effects were somewhat pronounced.—London *Electrician*, Sept. 26, 1913.

Electric Measuring Machines.—P. E. SHAW.—An illustrated abstract of a paper read before the (British) Institution of Mechanical Engineers in which the author describes the construction and use of an improved model of a special type of measuring machine for proving standard gages. The original model was made in 1905 and has been in use in the National Physical Laboratory since 1909. The new model is quite similar, but embodies various improvements in its construction and in the electrical methods used to indicate the contact of the micrometer device with the gage being measured. The accuracy of measurement is as high as 0.2 micron. The machine is applicable to all regular metallic or non-metallic solid bodies, whether cylindrical, spherical or parallel-faced.—London *Electrician*, Oct. 10, 1913.

Installations, Systems and Appliances

Lightning Arresters.—An illustrated description of a new form of aluminum lightning arrester. The air-gap has been eliminated by making the aluminum cell in the form of a chain of aluminum links, thus forming a series of aluminum couples which reduces the potential across any pair to 1 volt or 2 volts and avoids heating of the electrolyte. The aluminum chain, immersed in glycerine, is threaded spirally through a central insulating pillar, round which is an outer insulator wound with a choke coil of stranded copper cable which is inserted in the line circuit.—London *Electrician*, Oct. 10, 1913.

Switching Operations.—W. W. LEWIS.—An article illustrated by diagrams of switching operations on low- and high-tension systems with special reference to the safest methods. Wiring diagrams accompanied with numerous oscillographic records cover each of the general classes of switching that occur in practice and enable the fundamental principles thus established to be applied to the more complicated cases of switching. As little switching as possible should be done under tension. When such switching under tension is necessary it should preferably be done on the low side, both when starting up and when shutting down.—*Gen. Elec. Review*, October, 1913.

Electrophysics and Magnetism

Magnetism.—S. B. MCLAREN.—An abstract of a paper read before Section A of the British association outlining a basis for a new theory of magnetism.—London *Electrician*, Oct. 10, 1913.

Telegraphy, Telephony and Signals

German Telegraph Experiment Station.—K. STRECKER.—The first part of a fully illustrated article on the organization and scope of the German telegraph experiment station. The object is research work on telegraphy, telephony, wireless telegraphy, construction of overhead lines and cable lines, interaction between power transmission lines and telegraph and telephone lines, etc. The author describes the office building and its equipment.—*Elek. Zeit.*, Oct. 9, 1913.

High-Frequency Generator for Wireless Work.—RICARDO MORETTI.—A note on a new high-frequency generator which is a modification of the Duddell singing arc, but is distinguished from the latter and from Poulsen's generator by the fact that continuous wave trains are not

obtained from Moretti's apparatus. The direct-current arc is operated in series with a suitable ballast resistance, and is shunted by a capacity and inductance as shown in Fig. 4. The positive electrode of the arc is hollow and is traversed by a continuous stream of water (or other cooling liquid). The water cools the electrode, and on entering the arc it is dissociated by the combined effect of heat and electrolysis and an extremely rapid series of explosions occurs in the arc, thus setting up energy surges, the frequency of which is said to be about 100 kilo-cycles per second. These discharges in the arc circuit set up oscillations in the circuit KL of frequency $F = 1/T = \frac{1}{2}\pi\sqrt{LK}$. The frequency of the arc discharges is generally considerably lower than the natural frequency of the oscillating shunt circuit KL, so that damped wave trains are obtained—more or less closely following one another according to the frequency

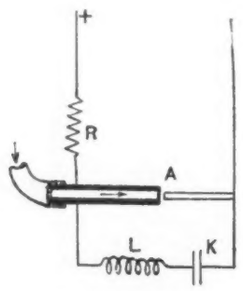


FIG. 4—DIAGRAM OF CONNECTIONS OF HIGH-FREQUENCY GENERATOR FOR WIRELESS WORK

of the arc discharge. Hydrogen inclosure of the arc is not required. Using this generator, a hydraulic microphone and the usual arrangement of aerial, Moretti claims to have achieved satisfactory wireless telephonic communication from Centocelle (Rome) to Tripoli.—*L'Elettricista;* abstracted in London *Elec. Review*, Sept. 26, 1913.

High-Speed Telegraph.—A. Franke.—The conclusion of the illustrated description of the new high-speed telegraph system of the Siemens-Halske company, which is now used on five lines of the German telephone system radiating from Berlin.—*Elek. Zeit.*, Oct. 9, 1913.

Sine-Wave Transmission in the Submarine Telegraph Cable.—H. W. Malcolm.—The first part of a mathematical article illustrated by diagrams. In the sine-wave transmitter an elementary signal is formed by a single semi-period of a sinusoidal emf, instead of by the positive or negative battery contact which is at present employed in cable telegraphy. Before the importance of this change can be understood, a study is necessary of the theory underlying the transient effects which accompany the introduction or removal of periodic electromotive forces in cables. A single semi-oscillation may be regarded as being made up of two prolonged trains of oscillations, the second displaced and superposed on the first. A formula is obtained whereby the transient current produced by the sudden introduction of a periodic emf can be readily calculated, and it is shown that, although the periodic effects predominate at the sending end, the phenomena at the receiving end are almost entirely transient in nature. A general theorem is deduced regarding the signals produced by any symmetrical emf, from which it appears that they are independent of the shape of the sending emf and dependent only on its mean value. That being so, it is permissible to choose—without regard to the receiving end—the emf which produces least shock at the sending end, and in this respect the alternator is superior to the battery.—London *Electrician*, Oct. 10, 1913.

Miscellaneous

Resinous Insulators.—A note of two recent British patents (No. 23,776, 1912, and No. 24,059, 1912) of the British Thomson-Houston Company and the American General Electric Company. An insulator which can be molded is produced by bringing into contact with a liquid solvent an infusible reaction product of phthalic anhydride and a polyhydric alcohol. In another process camphoric acid is heated with a polyhydric alcohol like glycerol.—London *Elec. Eng'ing*, Oct. 2, 1913.

Book Reviews

Handbuch der Elektrizität und des Magnetismus. In fünf Bänden. Edited by Prof. Dr. L. Graetz. (A compilation.) Vol. IV. Paper, 270 pages, 178 illus. Leipzig: Johann Ambrosius Barth. Price, 10 marks.

This is Volume IV of the series forming a five-volume textbook on electricity and magnetism, from the standpoint of the physicist rather than of the engineer. This volume deals with magnetism and electromagnetism. The work is thorough and scholarly. It is divided into three sections, dealing respectively with magnetism generally, the theory of magnetic induction, and magnetic measurements. The volume lacks an index of subject matter, which it must be hoped will be supplied with the complete series. A full consideration is offered of the apparatus for measuring the earth's local magnetic field.

Bau Grosser Elektrizitätswerke. By G. Klingenberg. 180 illus., 7 tables. Berlin: Julius Springer. Price, 12 marks.

An engineering descriptive treatise on the construction of large electric central stations, especially from the standpoint of the steam engineering constructor. The book is divided into six main sections, dealing with the following topics: Outlines of central-station construction, costs of electric energy transportation, economics of central power stations, basis for charges, the stations of the Victoria Falls & Transvaal Power Company. The book is well illustrated with diagrams and drawings taken from existing central stations. It is clearly written, from the economic standpoint, and contains much information of interest to the constructing engineer.

Examples in Applied Electricity. By C. G. Lamb. London: Cambridge University Press. New York: G. P. Putnam's Sons. 62 pages. Price, 75 cents.

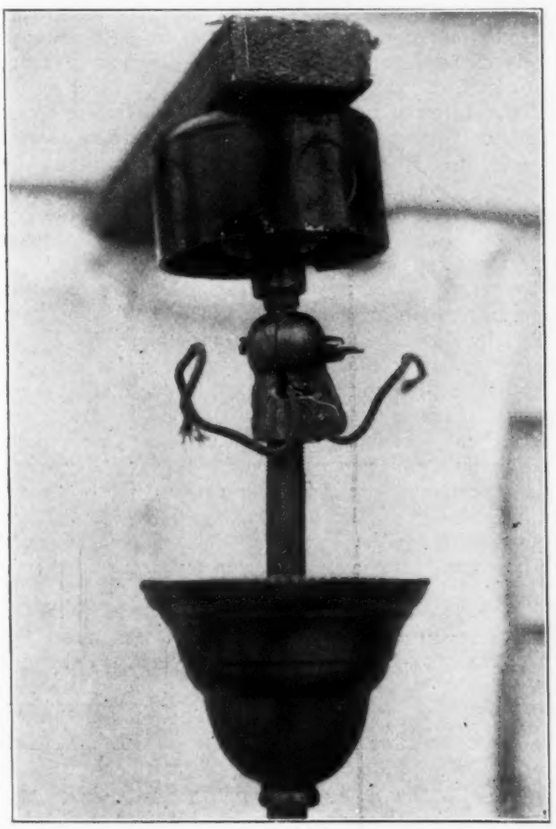
A collection of test questions covering the theory and applications of electricity, intended mainly for the use of instructors. These questions cover nearly the whole field of electrical engineering, with the exception of polyphase currents. Special subjects such as telephony, wireless telegraphy, electrochemistry, ore reduction, etc., are not included. A thorough grounding in the elementary theory of magnetism and electricity is required of the student who would solve these problems. The collection, which includes dynamo-electric machinery, alternating currents and energy transmission, has been compiled mainly from test papers set to students in the Engineering Laboratory, Cambridge, England. The answers are printed together at the end of the booklet, but, except for occasional very brief indications as to intermediate steps, the method of working out the problems is not stated. The results are given to the accuracy of a 10-in. slide rule—a commendable feature. To how great an extent a compilation of definite test questions is available for use without modification by any but the originator it is not very easy to determine, but, as containing suggestions to teachers of electrical engineering, not only in preparing test questions of their own but also in shaping or improving their courses, this particular publication should be of considerable value.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Device for Hanging Lighting Fixtures

The Electro Development Company, New York City, has just placed on the market a useful device to aid wiremen in hanging lighting fixtures properly. This "hang straight," as it is called, consists of a ball-and-socket joint tapped at the lower end to receive the threaded end of the pipe on the lighting fixture. In installing the fixture with this device the wireman fastens the base to the ceiling, or, as shown below, installs the outlet box and places the insulating joint in position. The lower half of the "hang straight" is then put on the pipe and the socket part fitted to the ball. Placing the threaded pin through the center of the ball allows the fixture to hang freely and to reach a vertical position under the action of gravity. With the fixture in this position the wireman has but to tighten the wing nut and place the canopy over the completed job. An adjustable tripod with a set screw in each leg is attached to the device when it is to be used for wall-bracket work.

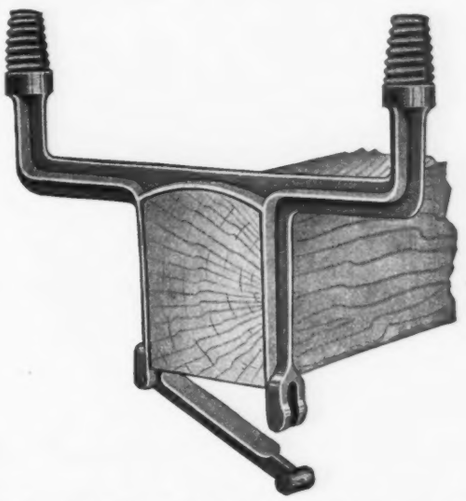


DEVICE FOR HANGING LIGHTING FIXTURE STRAIGHT

Turning these set screws aligns the fixture. To the wireman who knows the difficulty of aligning fixtures the practicability of this device is at once apparent. All edges where the wires might come in contact with the brass are carefully smoothed to avoid abrasion. The device has met with the approval of the National Board of Fire Underwriters.

Boltless Bracket

The accompanying illustration shows a new type of boltless bracket or arm clamp pin manufactured by the Line Material Company, South Milwaukee, Wis. The bracket is made of galvanized malleable iron and has a pivoted arm fitted with knob which, when driven home with a small hammer, springs over a slight ridge on the stationary arm of the bracket.



GALVANIZED MALLEABLE IRON BOLTLESS BRACKET

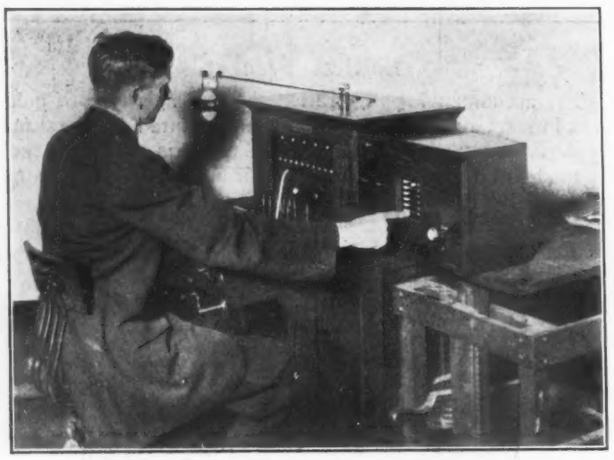
This method of fastening the clamp makes installation easy and rapid and eliminates the trouble resulting from loss of nuts and rusting at the bolt threads. The manufacturers claim that the use of this type of clamp bracket will add many years of life to an old or split pole-arm besides insuring long life to new arms since no holes need be drilled reducing their cross-section. The pins are split at the top and are provided with felt insertion so that they allow of some variance in the internal insulator threads.

Display Scheme with Colored Lamps

In physics the fact is well known that a surface of a given color can be illuminated only by light of the same color, and that under any light not containing its own color such a surface will appear dark or black. A rather novel application of this principle was made by the National Quality Lamp Works of the General Electric Company in its recent exhibit at the New York Electrical Show. In this display a series of placards rising from a dark background were illuminated by light reflected from colored lamps placed in front and at the sides of the cards. A flasher connected to the lamp circuits alternately switched on the lamps of different colors, and as the light fell upon the colored placards portions of the pictures seemed to disappear owing to the neutralizing effect of the colored light that was employed. The effects which were obtained in this manner attracted not a little attention from those attending the show, the exhibit being of a nature to arouse general interest and curiosity.

Telephone Call System

Telephonic apparatus designed to enhance the value of telephone service in large commercial establishments by quickly locating individuals not within hearing distance of their telephones has recently been brought out by the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. The "call-a-phone system," as it is



"CALL-A-PHONE" WITH FIRE-ALARM ATTACHMENT

known, includes a signal-transmitting device mounted within reach of the branch exchange operator and a system of bells placed in the various parts of the plant. These bells are rung simultaneously under the controlling action of the sending device.

The energy which is required to provide for the operation of the system is drawn from the telephone storage batteries, or in the case of isolated systems from a bank of dry cells having a potential of but 20 volts, thus keeping the system at all times within the rules established by the National Board of Fire Underwriters for low-voltage signal systems.

The sending device shown in the illustration consists of a neatly designed and finished cabinet, measuring 15 in. by 11 in. by 9 in., and containing all of the apparatus required for the projection of the current impulses used in forming the code signals. Twelve distinctive code signals can be transmitted with this particular sending device. The interlocking push-button key switches for these impulses will be seen in the center of the front panel, together with the pilot lamp and master key. A directory plate is associated with the selecting keys for the insertion of the name of the party responding to each code signal.

The loud-ringing gongs distributed throughout the plant operate in parallel on a two-wire circuit consisting of ordinary interior-type twisted-pair telephone wire. Any reasonable number of bells may be connected to one circuit, but fifteen is recommended as a limit. For offices small bells or buzzers may be substituted for the gongs at the option of the telephone users.

In addition to the code signaling features of the equipment the system is equipped with a fire alarm. For this purpose leads from the usual type of "break the glass" fire-alarm boxes installed in various parts of the plant are terminated upon the visual signals shown in the lower portion of the first panel of the sending device. When an alarm is turned in from any of the fire-alarm boxes the corresponding visual signal is displayed to indicate the location of the fire and a general alarm is automatically sounded by the sending device. A fire-alarm switch is also included in the equipment of the sending station for convenience in sending alarms for fires which are reported by telephone.

Constant-Voltage Axle-Lighting Equipment

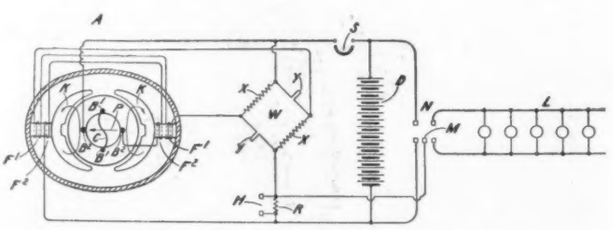
At the convention of the Association of Railway Electrical Engineers which came to an end in Chicago on Oct. 24 the Electric Storage Battery Company, of Philadelphia, exhibited for the first time its new constant-voltage axle-lighting equipment. It is something of a departure for this company to manufacture complete axle-lighting equipments, and considerable interest was taken in the apparatus. The system, which has been tried out successfully on the Santa Fé Railroad, is illustrated diagrammatically herewith. Its feature is the use of a constant-voltage rather than a constant-current value for charging the storage battery.

The dynamo *A* is of the so-called Rosenberg type, described by Dr. E. Rosenberg on page 918 of our issue dated Nov. 10, 1906. It is so arranged that the armature can be rotated in either direction without change in the polarity generated. The machine has been redesigned under the direction of Mr. J. Lester Woodbridge, chief engineer of the Electric Storage Battery Company, who has developed the entire device to its present state.

Current in the primary field winding F produces a small primary field flux represented by the arrow P, which induces an emf between the short-circuited brushes B^1 and a flow of current through the short-circuited connection C. This current, flowing through the armature winding, produces, by armature reaction, the secondary or principle field flux, which does not pass through the frame of the machine but is confined to the heavy pole-shoes and the armature, as shown by the arrows K. This principal flux produces an emf at the principal brushes B^2, which are connected to the external circuit, a series-field winding F^2 in this circuit serving to balance the armature reaction due to load.

In the primary field winding F^2 there is connected a Wheatstone bridge as indicated. Other junction points are connected to the positive and negative terminals of the machine. This bridge is designed to give the constant-voltage characteristics. It includes fixed resistances X and iron-wire ballasts Y. The latter, on account of their high temperature coefficient, are said to give a practically constant-current characteristic under operating conditions. This combination of circuits produces a field excitation continually diminishing with increase of speed. An automatic switch S connects the dynamo to the battery D when the machine voltage is slightly above that of the battery, and opens when the output of the dynamo drops to zero. The knife switch N connects the lamp circuit L to the battery.

The machine voltage is fixed at a point slightly above the floating voltage of the cells. Should it ever be found necessary to give the battery a high-voltage charge, this may be done during a daylight run by means of the fixed



CONSTANT-VOLTAGE AXLE-LIGHTING EQUIPMENT

resistance R, normally short-circuited by the switch H and also by the clip M on the main lamp switch. When both of these switches are open the voltage of the dynamo is raised by an amount determined by the value of the resistance R. Whenever the lamps are to be lighted the closing of the switch N short-circuits the resistance R, reducing the potential to normal and eliminating the possi-

bility of excessive voltage at the lamps. It is declared that this system adjusts automatically the output of the dynamo to the requirements of the service and gives the slight amount of overcharge required to keep it in good condition. The equipment is provided with a switchboard containing the automatic switch, ampere-hour meters for the battery and dynamo circuits, fuses, etc. There is also a control panel containing the Wheatstone-bridge field control. No lamp regulator is required in the operation of this system.

In an address on the subject of this new equipment, given in Chicago Oct. 21 during the convention mentioned, Mr. Woodbridge remarked that this axle-lighting system has been developed by his company primarily from the storage-battery point of view, rather than from the dynamo point of view. He said that two new principles have been introduced: First, the dynamo controls the voltage on the circuit and therefore controls the voltage maintained at the battery terminals, instead of the battery controlling the voltage of the dynamo. Second, the dynamo is designed for constant voltage rather than constant current. This constant voltage is adjusted slightly above the normal floating point of the battery at a value just sufficient to keep the battery always practically "full." The charging voltage adopted is about 2.25 volts per cell. This has been considered low, but Mr. Woodbridge declared that actual tests have shown it to be sufficient not only to keep the battery charged but to recharge it after a complete or partial discharge.

The equipment includes sixteen cells of battery with Manchester plates. A potential of between 35 volts and 36 volts is maintained across the battery terminals when the dynamo is in operation and is sufficient for satisfactory operation. Mr. Woodbridge said that as long as the changes in voltage are gradual a considerable range in the intensity of illumination may be permitted in car lighting without producing unsatisfactory results. He thought a variation of from 35 volts down to 32 volts would not be objectionable, provided the fluctuations are not rapid. Lamps rated for 32-volt circuits have been used so far with this equipment, but if the cost of lamp renewals should be considered high on account of over-voltage, there is said to be no reason why 34-volt lamps should not be substituted. Mr. Woodbridge spoke of the fact that an equipment of this sort has been in use over 160,000 car-miles within a year on the Santa Fé without light failure or delay, or any charging of the battery except that given by the axle-driven dynamo en route.

Electric Signaling Apparatus for Construction Work

The electric signaling apparatus recently tried out on the new Municipal Building in New York City has several features of interest and is without doubt a step toward better signaling for construction hoists. In this signal system a

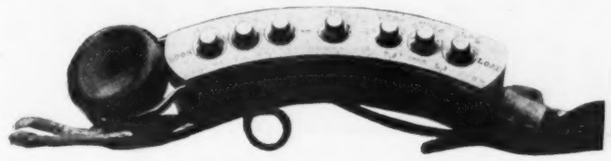
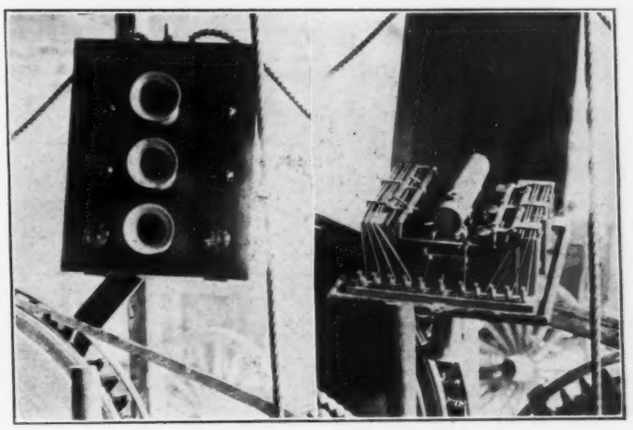


FIG. 1—KEYBOARD ATTACHED TO SIGNALMAN'S BELT

conducting cable containing several insulated copper wires is run from the engineer's station to the signal man. The man who gives the signal wears a belt to which one end of the conducting cable is attached, and this belt carries a number of buttons, which are marked so that there need be no mistake. The arrangement of the push-buttons will be evident from Fig. 1, which shows the entire keyboard attached to the signal man's belt. The signals provide for raising or lowering the load at high or low speed, for swinging the boom to the right or left, and for stopping each motion almost instantly. In constructing high buildings operators may be placed at several points to watch the travel of the hoist and signal the engineer.

At the hoisting engine the signals are given to the engineer by colored lamps operated simultaneously with electric siren horns. Fig. 2 shows the signal box at the engineer's station, when it is closed, and Fig. 3 shows an interior view of the same box.



FIGS. 2 AND 3—OUTSIDE AND INTERIOR VIEWS OF SIGNAL BOX AT ENGINEER'S STATION

One of the most important features of this apparatus is the recording device by means of which every signal given is recorded upon a paper strip, which may be in the chief engineer's office. Every movement of the hoisting cable and of the boom is also recorded. In the event of an accident through the misunderstanding of signals or from any other cause, it is thus easy to fix the responsibility. To guard against accidents due to the interruption of signals by the breakage of the armored conducting cable, a safely circuit is provided consisting of a continuous wire running through the entire length of the cable. If by any accident the conducting cable should be damaged sufficiently to break the wires, the cessation of the current in this safety circuit immediately causes an alarm bell to ring at the engineer's station.

Mining, subway tunneling, bridge building and the like are cited as other applications for this apparatus by its manufacturer, the Y. & G. Electric Fuse & Engineering Company, Bayonne, N. J.

Electric Range for Hotel Service

At the New York Electrical Show an electric grill and tea room was run in connection with the New York Edison Company's exhibit, the food served being cooked wholly with electrical devices, which comprised a hotel-type range, a grill of the same pattern and two ovens. To serve the large number of people who patronized the grill room it was necessary that the range be operated at its full capacity from 9 o'clock in the morning until 10 o'clock at night, and it proved to be quite indispensable. On several occasions 75-lb. roasts were cooked. As told by the chef at the electric grill the average day's work for the range consisted of roasting 30 lb. of beef, baking half a bag of potatoes, broiling about 250 chops and 200 young chickens, and keeping soups and other foods warm. During each day approximately 600 patrons were served from this electric kitchen.

The range, illustrated herewith, is provided with two

roasting ovens and a top cooking surface comprising eight rectangular hot plates. The ovens are of liberal size, being 18 in. wide, 16 in. high and 28 in. deep. They have double walls and are insulated with navy "firefelt" placed between the walls to prevent the escape of heat. The compartments are ventilated by means of flues which communicate with an opening in the top of the range. Each oven is provided with

ELECTRIC RANGE FOR USE IN HOTELS

two calorite heating units of the two-heat type, one being located at the top and the other at the bottom, thus giving a range of four heats for each oven with power consumptions for the respective heats amounting to 1.6, 2.4, 3.2 and 4.8 kw.

The eight rectangular hot plates are all of the same size, 9.25 in. wide by 12 in. deep, and the heating unit of each is designed for but one heat. The power consumption of each of the four front units is 1600 watts as they are designed to develop a high temperature for rapid work, while that of the back four is 800 watts, rendering them suitable for slow boiling.

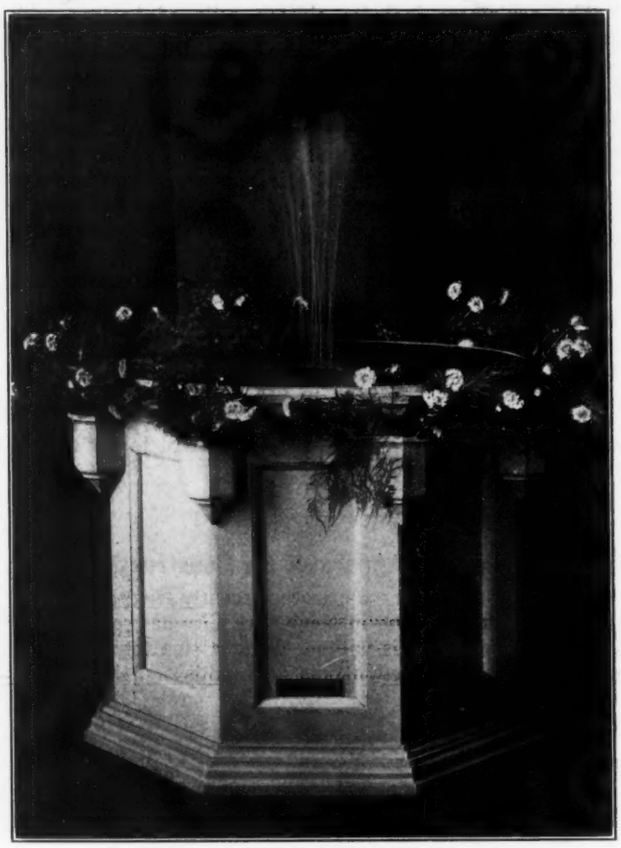
The main circuit is closed through a double-pole circuit-breaker, and in addition the circuits to the individual heating units are protected by fuses and controlled by knife switches. Switches, fuses and circuit-breakers are mounted on a slate panel located at the top of the range and inclosed in a sheet-metal compartment provided with a roll-top door. The heating unit which each switch controls is indicated by a name-plate placed directly above the latter's handle, so that to ascertain what units are in operation one has only to roll up the door and glance at the switches. An aperture at the bottom of the compartment insures circulation of air over the panel devices. Conductors are brazed to the calorite heating units, so that there are no connections that are likely to work loose from alternate heating and cooling. These conductors are carried through conduit to the connection blocks and there connected to the terminals of the respective power circuits.

The framework of the range is substantial, being constructed of angle-irons firmly bolted together. The range front and the door frames are of heavy steel plate, while the hot-plates and end frames of the panel-box are iron castings. The walls of the oven are of sheet metal. All sheet-metal parts are of blued steel, while the other parts are finished in marine or dull black. The heating units are replaceable and the design is such that the hot plates can be raised up to permit cleaning the catch pan located below them.

The over-all dimensions of the range are: Width, 44 in., depth, 38 in., and height, 68 in. It is manufactured by the General Electric Company, Schenectady, N. Y.

Electric Fountain Without Water Connections

In the booth of the United Electric Light & Power Company there was displayed at the New York Electrical Show which was lately held an electric "rainbow" fountain" which has attracted considerable attention. The fountain is self-contained, requiring no water connections and no electrical connections, as sufficient energy can be taken from the ordinary lamp socket for its operation. Five gallons of water kept in circulation by a small motor-driven pump is forced through a glass bowl, and the numerous streams, breaking into a vaporized spray, are drained into a tank below to be used again. The base of the fountain is octagonal in form and the eight panels are surmounted with cut flowers and growing plants. An automatic projector in the base of the fountain periodically changes the color of the glass bowl from which the water flows, and these color changes when caught up by the falling drops produce striking color effects.

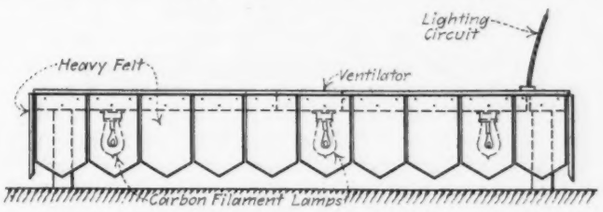


ELECTRIC-FOUNTAIN EXHIBIT AT NEW YORK ELECTRICAL SHOW

This fountain was built by the Feature Advertising Company, 209 Pacific Street, Brooklyn, N. Y. It was equipped at the show with a set of specially designed "temple" bells for musical effects. The bells, which were operated automatically with piano accompaniment, were installed by the Yerkes Sound Effects Company, whose headquarters are in New York City.

Electrically Heated Chick Hovers

The Standard Electric Incubator Company, New York City, which is marketing an electrically heated chick hover, claims to have solved successfully the problem of keeping small chicks alive after they have been hatched. The scheme of the hover manufactured by this company is indicated by the accompanying illustration. Its construction is



ELECTRICAL CHICK HOVER

simple. A square platform of light pine boards is mounted on four wooden legs. The edges of the pine platform are draped with heavy felt which has been slit at intervals to admit the chicks. The size of the platform and the number of carbon-filament lamps in the hover are determined by the number of chicks which are to be taken care of. It is stated that at least one lamp should be installed for each thirty chicks, and ample room should be provided so that there will be no crowding. Many heat sources are provided instead of a large one with the same radiating ability in order to minimize the tendency prevalent in newly hatched chicks to crowd about the heat source, thereby injuring the weaker members of the brood. Ventilation is accomplished by natural draft entering under the edges of the felt and escaping at the opening shown in the center of the platform.

Projector Lamp with Uniform Candle-Power Distribution

A 32-cp metal-filament lamp of the standard shape projects only about 5.1 cp downward in the direction of the lamp axis, the bulk of the light being given off laterally. As the majority of chandeliers and other receptacles are arranged so that the lamps operate with their tips hanging downward, this irregularity in distribution, as shown in Fig. 2, often limits the useful light obtainable from the lamp. The objection can, of course, be remedied to some extent by the use of suitable reflectors, but it must be re-

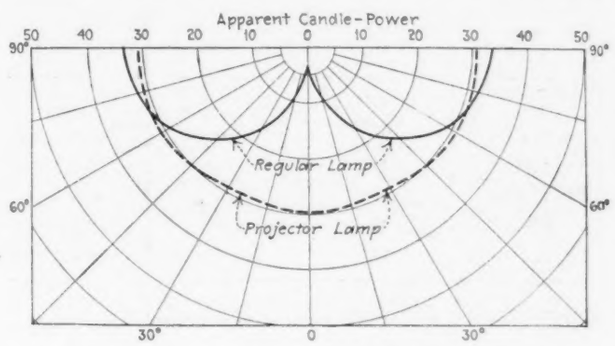


FIG. 1—MEAN VERTICAL DISTRIBUTION CURVES

membered that losses are certain to occur with every reflection.

The Philips Metall Gluhlampenfabrik A.G., Eindhoven, Holland, has taken up the construction of a type of lamp in which the filaments are so arranged that the candle-power is almost uniform in all directions. The filaments of this projector lamp do not run parallel with the filament support but lie stretched in a conical surface. Fig. 2 shows an end and side view of such a 32-cp projector lamp and its curve of light distribution is shown in Fig. 1. A comparison with the distribution curve of the standard metal-filament lamp in the same illustration will show that the effective downward illumination of the new lamp is nearly four times that of the ordinary unit, and that the candle-

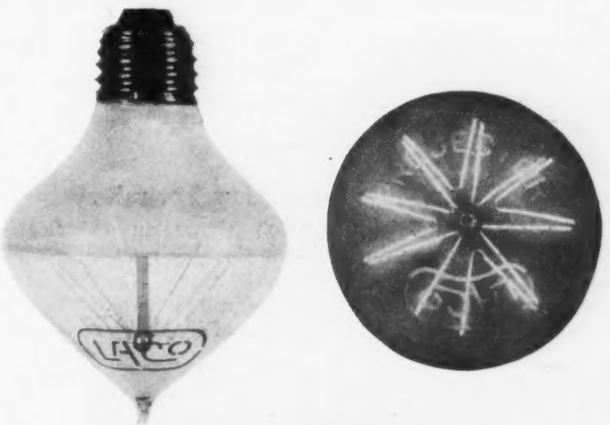


FIG. 2—32-CP PROJECTOR LAMP

power in a given direction remains the same whether the lamp is burned in a vertical, a horizontal or an inclined position.

Exhibits at Chicago Electric-Vehicle Convention

Makers of electric vehicles, storage batteries, motors, charging appliances, axles, tires, measuring instruments, automobile electric incandescent lamps and other accessories were represented at the Chicago convention of the Electric Vehicle Association. The manufacturers had rooms on the eighteenth floor of the Hotel LaSalle, and no heavy machinery or complete vehicles were shown. The vehicle manufacturers maintaining headquarters were the Baker Motor Vehicle Company, Cleveland; Chicago Electric Motor Car Company, Chicago; General Motors Truck Company, Pontiac, Mich.; General Vehicle Company, Long Island City, N. Y., and Walker Vehicle Company, Chicago. The last-named company exhibited its rear-axle driving unit, with a wheel casing removed to show the gears.

Five makes of storage battery were shown by the Edison Storage Battery Company, Orange, N. J.; Electric Storage Battery Company, Philadelphia; Gould Storage Battery Company, New York; K. W. Battery Company, Chicago, and Philadelphia Storage Battery Company, Philadelphia. All of them showed plates for vehicle-battery use. The Electric Storage Battery Company had a starting battery on display and the Gould company showed some interesting large plates of a type used in the submarine torpedo boats of American and foreign navies. The K. W. Battery Company, of Chicago, is a newcomer. It is the United States representative of Gottfried Hagen, Koelner Akkumulatoren Werke, Cologne, Germany, said to possess the oldest storage-battery factory in existence, the factory being under the technical direction of Dr. E. Sieg.

The General Electric Company, of Schenectady, exhibited a mercury-arc rectifier and various electric automobile lamps. The Electric Products Company, of Cleveland, demonstrated charging appliances for storage batteries, including the Wotton automatic rectifier.

The Fort Dearborn Manufacturing Company, of Chicago, had a new device that excited some attention in the shape of the Benson self-adjusting Hindley worm-gear axle.

Literature on the subject of small motors was distributed

by the Westinghouse Electric & Manufacturing Company.

Tires and tire auxiliaries were exhibited or talked about by the Firestone Tire & Rubber Company, Akron, Ohio; Goodyear Tire & Rubber Company, Akron, Ohio; F. E. Sparks, Chicago, and United States Tire Company, New York.

Ampere-hour meters and garage-type watthour meters were shown by the Sangamo Electric Company, Springfield, Ill. The Commonwealth Edison Company distributed central-station literature and the *Electrical World* displayed samples of electric-vehicle data.

Electric-Lighted Shadow Portrait

The accompanying illustration shows an electrically lighted "shadow portrait" of Hon. W. J. Bryan, Secretary of State, which was exhibited at the recent National Conservation Exposition at Knoxville, Tenn., where Mr. Bryan was a guest of honor. The features of the face are formed

ELECTRIC-LIGHTED SHADOW PORTRAIT OF SECRETARY OF STATE BRYAN

by the usual channeling of the lower reflecting surface. Opal color-caps are used on the tips of the lamps, the density being so chosen that the caps, viewed by transmitted light, are of the same intensity as the reflecting surface at the bottom of the channels. Owing to this lack of contrast, the lighting units themselves are rendered practically invisible, while the features and lineaments stand out in distinct and lifelike fashion. Color can be chosen to make the display resemble the tints of real life, and any portrait or picture can be reproduced with artistic effect. This novelty in electric-sign advertising is being introduced by the Greenwood Advertising Company, of Knoxville, Tenn., and Los Angeles, Cal.

When Mr. Bryan visited Knoxville and was shown this electrically lighted portrait he appeared greatly pleased with the likeness and commended the lifelike appearance of the picture. Following his exhibition of interest, the Greenwood company presented the display to him.

Metallized Graphite for Bearings and Collector Brushes

A new metallized-graphite product suitable for self-lubricating bushings, for collector brushes on dynamo-electric machinery, for packing rings in steam turbines and for many other uses where a self-lubricating metal is desired is being put on the market by the Graphite Metallizing Corporation, Yonkers, N. Y. The basic element of "graphalloy," as it is called, is pure graphite, and to this constituent by a process of impregnation is added a molten metal to give the completed product solidity that it may be machined to the desired form and have the requisite strength and durability. The process of impregnation of the graphite with the metal is accomplished by the use of air pressures of high values, such as have hitherto been considered commercially impracticable.

Graphalloy has a high compressive strength and can be accurately machined, threaded or tapped with no more difficulties than are met with in working brass. For machining a speed about 25 per cent in excess of that used for brass is to be recommended. Some of the most important mechanical properties are given in the accompanying table.

MECHANICAL PROPERTIES OF GRAPHALLOY

Weight of solid graphite electrodes per cubic inch (in pounds)	0.057
Weight of graphalloy impregnated with babbitt (in pounds)	0.145
Increase in weight due to impregnation (in per cent)	150
Specific gravity of graphalloy	0.4
Percentage of metal in graphalloy (by weight)	60
Percentage of metal in graphalloy (by volume)	25
Compressive strength of graphalloy (in pounds per square inch)	14,000
Modulus of rupture	12,500

The lubricating qualities of this product are said to be practically those of graphite. It has been found that bearings made of this material will run somewhat hotter than similar bearings lubricated with oil, but this result is accounted for by the fact that graphalloy is a relatively poor conductor of heat. However, it is said that in no case will a temperature of less than 400 deg. Fahr. injure the graphalloy of the bearing or cause it to seize the shaft. This product is not advocated for all classes of service, but the manufacturers claim that on light-duty machines operating at high speeds excellent results can be obtained.

For use on circuit-breakers and other electrical contactors graphalloy is made from pure graphite and copper or

DATA ON METALLIZED BRUSHES

Pressure, Lb. per Sq. In.	Current, Amp.	Current Density, Amp. per Sq. In.	Contact Drop, Volts
1.0	12	48	0.090
1.0	25	100	0.177
1.75	12	48	0.053
1.75	25	100	0.066
2.5	12	48	0.045
2.5	25	100	0.052

brass as the service demands. Experiments have shown that for controller and circuit-breaker contacts which are being continually subjected to the action of an electric arc the best combination is graphite impregnated with brass, the theory being that the zinc in the brass vaporizes under the action of the arc and tends to disrupt it. It has been found that with this combination of materials less trouble is experienced from pitting. In cases where the lowest possible specific resistance is needed pure copper is used instead of brass. Graphalloy contacts are said to be entirely free from "freezing" troubles.

Tests made by the New York Testing Laboratories show

that graphalloy slip-ring brushes have a specific resistance of 20.77 microhms per cu. in. When these figures are compared with the specific resistance of a cubic inch of carbon, which is 1240 microhms, and of graphite, which has a specific resistance of 320 microhms per cu. in., it will be seen that the combination product presents a large advantage in conductivity.

The electrical characteristic of a metallized brush is an all-important item as it enters into the efficiency of the machine and the operating temperature of the slip-ring or commutator to which the brush is applied.

Herewith is given a table of the various contact drops in voltage at a speed of 2500 ft. per minute and at various pressures used in commercial brush holders.

From this table will be noted that the average contact drop is 0.07 volt, and upon comparing this with like tests on other types of brushes the manufacturers claim that it will be found much lower. The current-carrying capacity of graphalloy has been found to be approximately 200 amp per sq. in. However, the maximum allowable current density varies largely with the class of service and also with the limiting temperature of the brush.

Light Shaft-Driven Electric Commercial Vehicle

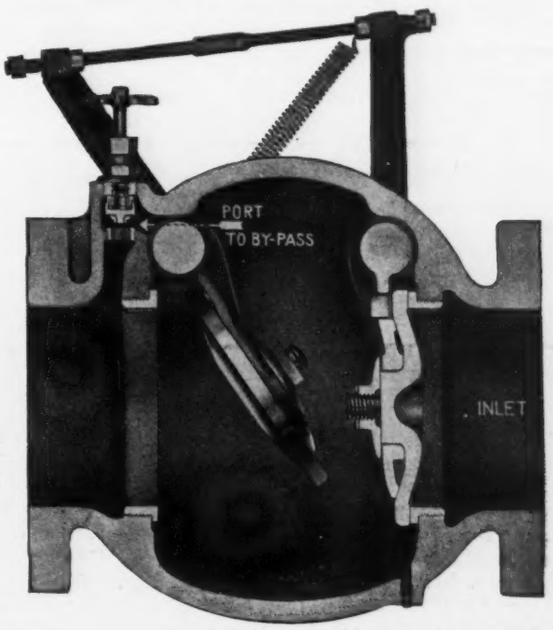
The new 1914 model 1000-lb. wagon of the General Vehicle Company, Long Island City, N. Y., has been designed to give a speed of 12 or 15 miles per hour and a mileage of from 45 to 65 miles per charge, depending upon battery equipment. The wheelbase of the truck has been increased from approximately 86 in. to 108 in. and the battery has been taken from under the frame and placed under the hood. Notwithstanding the increased wheelbase, the turning radius is about the same as was that of the shorter wagon and the inside lading space of the two is approximately equal.

The wagon is driven by a single motor through a double universal-joint shaft and worm drive in the rear axle. All wiring, including bell and lamp circuits, is installed in rigid metal conduit. The safety devices on the car are quite complete. Application of either brake immediately disconnects the battery from the motor. The emergency brake cannot be locked except when the running switch is in either the neutral or the charging positions and cannot be released until the switch is thrown into the running position. The running switch can be thrown into the running position only when the controller is on the neutral point. These devices increase the safety of the driver and the public and allow the vehicle to be left standing alone without undue danger of accident from accidental or mischievous interference.

1914 MODEL SHAFT-DRIVEN ELECTRIC COMMERCIAL VEHICLE

Emergency Cut-Out Valve

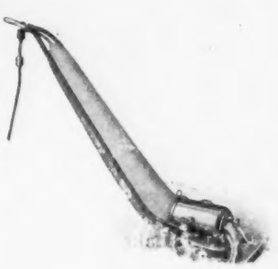
At the recent convention of the National Association of Stationary Engineers, Springfield, Mass., the Crane Company, Chicago, Ill., showed for the first time a new automatic, double-acting, non-return and emergency cut-out valve for boiler and header protection. This valve is made with a ferro-steel body and hard metal seats and disks, and is adapted for operation on steam pressures up to 250 lb. at a maximum temperature of 500 deg. Fahr. The valve may be arranged for electrical remote control and may be used for the protection of long lines of branch piping. The turnbuckle connecting the outside levers provides a ready adjustment for different operating conditions, the levers themselves giving a visible indication of the position of the clappers on the inside. External adjustments may be made with the valve in operation.



AUTOMATIC, DOUBLE-ACTING, NON-RETURN AND EMERGENCY CUT-OUT VALVE

Suction Sweeper with Large Air Displacement

The Duntley Products Company, Erie, Pa., has recently developed an electric suction sweeper capable of displacing 127 cu. ft. of air per minute. The exhaust of the device is made several times as large as the intake aperture, so that the fan does not have to work against high back pressure. The fan itself, which is 4.5. in. in diameter, is driven by a small motor which operates on either direct current or alternating current of a frequency of 60 cycles or less. The speed of the motor is 8000 r.p.m. The length of the machine exclusive of the handle is but 1 ft. and its height is 8.25 in. The nozzle is 10 in. long and 1.25 in wide inside. The entire equipment weighs about 15 lb. A feature of the cleaner is the method provided for removing the dirt bag. By unhooking this sack from the sweeper handle and pressing a clasp on the exhaust drum the bag can be lifted from its position without being touched.



ELECTRIC SUCTION SWEEPER

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

Growing Use of Electricity in China.—A recent report states that there are at present thirty-four electric-light plants in China and that the number is increasing gradually. In Shanghai it is reported that the increasing use of electricity for industrial purposes is attracting attention, a number of mills and factories there being supplied with electricity. It is stated that many of the leading American manufacturers have representatives in the field who are working to open up a demand for electrical apparatus.

Large Order Placed for Multiple Conductor Cable.—The city of Salem, Mass., has placed a large contract with the Simplex Wire & Cable Company, Boston, for multiple-conductor cables for a new fire-alarm system. Most of these cables are lead-covered for underground use and contain all the way from two to eighteen conductors, both in pairs and laid straight. In order to secure as permanent an installation as possible a 30 per cent rubber compound was specified for insulating the conductors. Charles H. Ashby is city electrical engineer.

Large Interest Shown in Electric Appliances.—In connection with the recent district fair of Northern Illinois, held at Streeter, Ill., it is stated by A. L. Roome, Illinois sales manager for the Hurley Machine Company, maker of electric washing machines, that there were probably over 70,000 visitors at the fair and that great interest was shown, especially by farmers, in the various electrical appliances on exhibit. He thinks that manufacturers of these lines and central stations may expect a big business during the coming year throughout this section.

Chicago Demand for Lighting Glassware Observed.—The H. Northwood Company, of Wheeling, W. Va., is enjoying, according to a recent sttaement of one of its representatives, an unusually brisk business in Chicago. This company, which has only comparatively recently entered the lighting field, is confining its attention to one line, the "Luna" ware, which is made up in various shapes and designs for direct and semi-direct illumination. The company's product is sold almost exclusively for commercial application ,and some export business is done to England.

Condensing Equipment Installed by Utility Companies.—The Cleveland (Ohio) Electric Illuminating Company has recently purchased from the Alberger Pump & Condenser Company, of 140 Cedar Street, New York, four 14,000-kw condensing units, consisting of turbine-driven condensation pumps, combined with Corliss engine-driven vacuum and circulating pumps. Apparatus of the same make has been installed by the Aurora, Elgin & Chicago Railway Company in its generating station at Batavia, Ill. This outfit consists of a 7500-kw three-impeller, turbine-driven circulating pump, a turbine-driven "Hydroflo" vacuum pump and a motor-driven condensation pump.

Boilers Purchased for Large Steel Plant.—The Otis Steel Company, of Cleveland, Ohio, has recently purchased from the Babcock & Wilcox Company, 85 Liberty Street, New York, boiler equipment of 3528 hp capacity with superheaters. Among the electrical concerns which have lately obtained boiler equipment from the same company are the Edison Storage Battery Company, Silver Lake, N. J., 900 hp; the National Quality Lamp Division of the General Electric Company, Cleveland, Ohio, 1024 hp, and the Toledo Bowling Green & Southern Traction Company, Findlay, Ohio, 1016 hp. The total of eleven large sales reported since the end of September amounts to 15,290 hp.

Electrical Equipment in the New Bradstreet Building.—In the new twelve-story Bradstreet Building in New York the generating equipment consists of General Electric steam-driven, direct current, three-wire units, two of 150-kw and one of 50-kw rating. The boilers were supplied by L. R. Merritt & Company, of 95 Liberty Street, New York. The building is wired with a panel on each floor divided into lamp and motor sections and arrangements are made for metering each class of service. On four floors of the building the wiring is arranged for printing-press drive and a number of Crocker-Wheeler motors have been installed for this service on one floor. The electrical contracting on the building was done by L. K. Comstock & Company, of 30 Church Street, New York.

Electric Sign Manufacturers' Association Organized.—Announcement has just been made of the organization of the National Association of Electric Sign Manufacturers, membership in which is composed of two classes, the first including manufacturers of electric signs and electrically illuminated advertising displays, and the second embracing makers of electric sign materials and accessories. The formation of such an association has been discussed for some time and its objects are, in brief, to combat hostile legislation in the form of unfair restrictions and taxes, to provide a means for co-operative booming of the sign business, to protect sign manufacturers from dishonest agents, to produce and maintain a standard of material, workmanship and design, and to combat the evil of design piracy. In the latter field its efforts will be similar to the work of the Registration League of Philadelphia. The secretary of the association is Mr. Lloyd E. Brown, 315-321 South Warren Street, Syracuse, N. Y.

Officers of Railway Electric Supply Manufacturers' Association.—Officers of the Railway Electric Supply Manufacturers' Association have been elected as follows: President, C. W. Bender, Cleveland, National Electric Lamp Association; senior vice-president, W. F. Bauer, Chicago, United States Light & Heating Company; junior vice-president, H. G. Thompson, New York, Edison Storage Battery Company; secretary, Jesse Scribner, Chicago, General Electric Company; treasurer, Edward Wray, Chicago, *Railway Electrical Engineer;* executive committee, George H. Porter, Western Electric Company; B. L. Winchell, Jr., Kerite Insulated Wire & Cable Company; J. M. Lorenz, Central Electric Company; W. E. Ballantine, Willard Storage Battery Company; A. C. Moore, Safety Car Heating & Lighting Company; J. T. Dickinson, Gould Coupler Company; H. E. Watson, Benjamin Electric Manufacturing Company; G. H. Atkin, Electric Storage Battery Company; F. F. Skeel, Crouse-Hinds Company. This association is auxiliary to the Association of Railway Electrical Engineers.

Constant-Voltage Axle-Lighting System Described.—Constant-voltage axle-lighting systems are something new, and it is also a departure for the Electric Storage Battery Company to manufacture complete car-lighting equipments. Therefore considerable interest was taken in the informal dinner given on the evening of Oct. 21 in the Hotel LaSalle, Chicago, at which time the new equipment was described. This dinner was held during the convention of the Association of Railway Electrical Engineers, and about fifty railroad men were present. G. H. Atkin, manager of the Chicago office of the Electric Storage Battery Company, presided, and the principal address was made by J. Lester Woodbridge, of Philadelphia, chief engineer of the company, who has developed the device. Considerable discussion followed Mr. Woodbridge's talk, the questions relating principally to possible sulphating of the batteries and to the electrical characteristics of the constant-voltage Rosenberg dynamo which is used. One fact mentioned was that the machine will not run as a motor, although it will run either way as a dynamo without change of polarity. The Atchison, Topeka & Santa Fé Railway Company has had one of these axle-lighting sets in practically continuous

operation since November, 1912, with very satisfactory results, having covered in the neighborhood of 160,000 miles with a minimum of attention, no repairs and no failure or delay in the lighting service. This set gave such satisfaction that in April, 1913, an order was placed with the manufacturers by the railway company for sixty-two similar equipments. Several of the railway electrical engineers expressed cordial appreciation of the original work of the company in bringing out the device, and a vote of thanks was carried unanimously.

Incandescent Lamp Laboratories Established.—The H. J. Jaeger Research Laboratories, Incorporated, have been organized for the purpose of pushing the manufacture of tungsten lamps among the independent lamp makers. It is planned to do extensive research and development work on a co-operative basis, which will allow of carrying on large tests and experiments for the benefit of contributing companies that could not afford to undertake such tests unassisted. The laboratories will aim to keep both the design of the lamps and that of the lamp-making machinery up to date and will try to effect a standardization of material and workmanship in the manufacture of tungsten lamps by the companies allied with them. In addition to the technical services above outlined, the laboratories will endeavor to supply information on the commercial end of the lamp business, provide patent protection, and keep in close touch with the European situation through connections in England, France, Germany and Austria. Herman J. Jaeger is president of the concern and Guy V. Williams is its secretary. The main office is at 116 Broad Street, New York, and the laboratories are located at 68 Hudson Street, Hoboken, N. J.

English Progress Along Electrical Lines.—According to a representative of one of the leading English electrical houses, interviewed during the past week, steady progress is being made in that country along electrical lines. At present there is a wide variation in voltages and frequencies which greatly retards the growth of the electrical industry along some lines, but this condition is being remedied in the design of new supply systems. Because of the early advances of the gas industry in that country, and also through the fact that there is hardly any building activity (such building work as there is being confined largely to the erection of new structures on old sites), the lighting end of the industry, which is generally the pioneer for other business, is greatly handicapped. However, all new residences, factories and business buildings are wired for electric service. Other influences which have tended to retard progress are the fact that the industry in England has not been concentrated into the hands of a few large interests, which could influence it readily toward uniform standards of design and correspondingly increased production efficiency, and also the fact that apparatus has been built for long service and low depreication rate and has been in many cases too valuable to scrap when improvements have appeared possible.

NEW YORK METAL MARKET PRICES

	Oct. 21 Bid.	Oct. 21 Asked.	Oct. 28 Bid.	Oct. 28 Asked.
Copper:				
Standard, spot*	....	....	15.87½	....
	Selling Prices		Selling Prices	
	£ s d		£ s d	
London, standard, spot*	74 17 6		74 15 0	
Prime Lake	16.75	to 16.87½	16.87½	to 17.00
Electrolytic	16.50	to 16.70	16.62½	to 16.75
Casting	16.37½	to 16.50	16.35	to 16.45
Copper wire base	17.50	to 17.62½	17.50	to 17.75
Lead		4.35		4.35
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f.o.b. smelter		7.50		7.50
Spelter, spot	5.35	to 5.45	5.40	to 5.45
Tin, spot	40.00	to 40.20	39.75	to 40.00
Aluminum:				
Prompt delivery	20.00	to 20.50	19.75	to 20.00
Future	19.75	to 20.25	19.75	to 20.00

*OLD METALS

Heavy copper and wire	15.00	15.00
Brass, heavy	9.75	9.75
Brass, light	8.50	8.50
Lead, heavy	4.20	4.20
Zinc, scrap	4.37½	4.37½

*COPPER EXPORTS

Total tons to Oct. 28 26,388

*From daily transactions on the New York Metal Exchange.

Corporate and Financial

Pacific Telephone & Telegraph Bond Issue Authorized.—During the past week the California Railroad Commission has authorized the issue by the Pacific Telephone & Telegraph Company of $3,000,000 in bonds, the proceeds of which will be used in part to retire the $850,000 of underlying bonds of the Sunset Telephone & Telegraph Company, and the balance for additions and improvements to the company's properties.

Standard Gas & Electric Notes Offered.—Through H. M. Byllesby & Company and the Continental & Commercial Trust & Savings Company, of Chicago, an offering is being made of $950,000 Standard Gas & Electric Company collateral trust 6 per cent notes, the unsold portion of the $3,000,000 issue authorized last June. For the year ended Aug. 31, 1913, earnings of the company applicable to interest on these notes amounted to $1,390,993.

Swiss Bankers Visit Public Utility Properties.—During the past month a tour of inspection was made by Messrs. Aubert and Lombard, representing banking interests in Geneva, Switzerland, the trip embracing some of the larger public utility properties in the North and South, as well as on the Pacific Coast. They are reported to have been particularly impressed by the possibilities of electric pumping for irrigation service, of which there is a considerable amount in the West.

Massachusetts Utility Plans Stock Increase.—A special meeting of the stockholders of the Electric Light & Power Company of Abingdon and Rockland has been called for Nov. 7 in order to secure approval for an increase of 472 shares in the capital stock of the company. It is planned to sell these shares to the present stockholders at a price to be approved by the Gas & Electric Light Commission on the basis of one share of new stock to each four shares of old stock held. This issue is being planned for the purpose of securing funds for the retirement of the floating debt of the company.

Eighth Annual Report of Ferranti, Ltd.—At the eighth annual meeting of the stockholders of Ferranti, Ltd., in London, on Oct. 24, the directors' report for the fiscal year ended June 30 was presented. The gross earnings for the year equaled £59,599 and the net earnings £9996. The depreciation reserve account was increased by £10,000 and £22,000 was added to the general reserve account. During the year £4,000 of the first mortgage debentures have been redeemed and the loan on second mortgage debentures has been reduced. The balance of the prior lien debentures have been redeemed by the issue of £34,200 of 6 per cent five-year notes.

Colorado Power Company Initial Dividend.—An initial dividend at the rate of 7 per cent per annum has been declared upon the preferred stock of the Colorado Power Company. This company was organized early in the year to take over the properties of the Central Colorado Power Company and the Leadville Light & Power Company. It operates hydroelectric generating plants at Shoshone and Boulder, with a present capacity of about 40,000 hp and an equal reserve capacity for future development. The two stations are connected by a transmission line and electricity is supplied to Leadville, Boulder, Georgetown, Denver and other cities in the vicinity.

Bond Interest and the Income Tax.—The Commonwealth Edison Company of Chicago is one of several companies announcing that they will continue to pay interest in full to owners of their bonds after Nov. 1, notwithstanding the new federal law providing for an income tax. The Commonwealth Edison Company will itself make good any deductions required by the income tax law. The Milwaukee Gas Light Company, a subsidiary of the American Light & Traction Company, is another of the corporations affected by the clause in this law which provides for the collection of the tax on bond interest at the source, and since the interest on its $8,000,000 of 4 per cent bonds is payable without deduction of any tax, the company will pay the tax for the six-month period just ended. The common-stock dividend of the American Light & Traction Company was paid on Oct. 31 instead of Nov. 1, owing to uncertainty as

to whether or not the tax deduction clause would apply to dividends as well as bond interest. It has since been ascertained that it does not so apply and the future dividends will be paid on the regular dates.

Pacific Coast Utility to Increase Preferred Stock.—A special meeting of stockholders of the Puget Sound Traction, Light & Power Company has been called for Nov. 3 to authorize an increase of $2,686,200 in the preferred stock. There is outstanding at the present time $12,045,600 of preferred stock, including $1,106,800 of non-interest-bearing preferred receipts, exchangeable for preferred stock. It is proposed to open the new issue to subscription by present stockholders at par on the basis of one share to every eleven shares of either common or preferred stock now held. This will provide for the maturity of $7,500,000 two-year 5 per cent notes on Feb. 1, 1914, and for extensions and improvements.

Sale of Common Stock of the American Cities Company.—In the Sept. 6 issue of the *Electrical World* note was made of the plan by which the control of the American Cities Company was to be purchased by the United Gas & Electric Corporation. Announcement is now made by Bertron, Griscom & Company that over 70 per cent of the stock of the former company has been deposited in accordance with the terms of the offer made by the latter concern and that the time limit on this offer has been extended to Nov. 10 in order to allow other holders of American Cities stock to take advantage of these terms. The depositary is the Pennsylvania Company for Insurance on Lives and Granting Annuities, of Philadelphia, Pa.

Change in Stocks of Massachusetts Lighting Companies.—Stockholders of the Massachusetts Lighting Companies have voted to authorize the trustees to issue 50,000 shares of cumulative preferred stock at $100 and 50,000 shares of common stock without par value, to be exchanged for the present outstanding stock on the basis of one share of new preferred and one of new common for each share of the old stock. Authority was also given for the issue of 30,000 shares of preferred and 30,000 shares of common stock, in addition to the above, at any time and under any conditions desired. The trustees expect to pay on Jan. 15 quarterly dividends of $1.50 per share on the preferred and 25 cents per share on the common stock. The present stock is to be deposited with the Old Colony Trust Company, of Boston, Mass.

General Electric Company Activities.—At the present time the "large order" business of the General Electric Company is reported to be somewhat decreased in volume from the figures of the past summer, a loss which is said to be in a good measure offset by an increase in the demand for small equipment and supplies. The company is doing business at the rate of about $2,000,000 per week now, according to reports, without any indications of an immediate decrease, and it is understood that there is enough business on hand to keep its plants in operation for the next six months. Unofficial estimates of the company's earnings for the fiscal year ending Dec. 31 have been placed as high as $120,000,000, and it is the general impression that they will be well above $100,000,000. It is expected that the surplus available for dividends during the present year will reach a higher figure than ever before in the company's history.

Pennsylvania Water & Power Company Extending Facilities.—The capacity of the Holtwood (Pa.) plant of the Pennsylvania Water & Power Company was recently brought up to 92,000 hp by the installation of a seventh generating unit of 16,000-hp rating. This leaves room in the power house for the future installation of three more similar units and it is reported that at the present rate of the company's growth another unit will be required early in 1914. The Consolidated Gas, Electric Light & Power Company, of Baltimore, secured from this company during its last fiscal year over 95 per cent of its electric energy supply for Baltimore, Md., and vicinity, and other purchasers of electric energy from the Pennsylvania company are the United Railways & Power Company of Baltimore and the Edison Electric Company, of Lancaster, Pa. It is reported that negotiations are in progress at the present time to supply electricity to the utility companies in Harrisburg and in York, Pa.

Business Notes

J. W. Bache & Company, of 50 Church Street, New York, have been organized to handle the products of the Morris Iron & Steel Company, of Frederick, Md., in the Eastern States, as well as the entire export business of the same firm.

H. F. Bowser, formerly manager of the New York office of the Tungstolier Works of the General Electric Company, has opened an office at 489 Fifth Avenue, New York, as lighting specialist and purchasing agent for lighting equipment.

E. I. Van Doren has recently opened an office at 343 River Street, Troy, N. Y., as manufacturer's agent for the Wagner Electric Manufacturing Company, handling a general line of electrical supplies and specializing in industrial lighting and power work.

The Alberger Pump & Condenser Company, of 140 Cedar Street, New York, announces the appointment of F. E. Getts, formerly with the Chicago office of the General Electric Company, as district sales manager of its Chicago office. The change was made on Oct. 20.

The U. S. Light & Heating Company, of 30 Church Street, New York, has removed its New England sales office from 84 State Street to 25 Irving Street, Boston, Mass. This change brings the sales office and service station under one roof and is expected to produce closer co-operation between the two departments.

The George Cutter Company, of South Bend, Ind., manufacturer of electric lighting fixtures and distributing apparatus, has opened Eastern offices at 258 Broadway, New York City. F. X. Cleary is in charge, making these his headquarters for the territory covered by the New England, Middle Atlantic and Southern Atlantic States.

The Splitdorf Electrical Company is making important changes in the organization of its branch houses in Detroit and Chicago. The Splitdorf Electrical Company of Detroit has been incorporated with C. E. Brelsford as president and W. J. Murray as secretary. R. S. Preble is president and E. A. Kelley secretary of the Splitdorf Electrical Company of Chicago, also recently incorporated.

New Industrial Companies

The Lighting Corporation, of New York, N. Y., has been incorporated with a capital stock of $10,000 by Emory S. Lewis, William L. Glenn and William B. Walsh, 1120 East Seventh Street, Brooklyn, N. Y.

The Empire Transformer Company, of Chicago, Ill., has been incorporated by Irwin J. Mendels, Frank D. Hearne and Edward A. Christoph. The company is capitalized at $10,000 and proposes to manufacture and deal in electrical goods.

The Bastian-Morley Company, of South Bend, Ind., has been incorporated by James P. Morley, J. P. Hayes and J. Morley. The company is capitalized at $100,000 and proposes to manufacture gas, gasoline and electrical machines, devices and appliances.

The Schutte Electric Company has filed articles of incorporation at Harrisburg, Pa., for the purpose of dealing in electrical apparatus and supplies. The incorporators are: George L. Kopp, Jacob C. Platz, Herman Schutte, T. R. Evans and Louis N. Shuman.

The Ak-Ray Corporation, of New York, N. Y., has been chartered with a capital stock of $100,000 by Sergius P. Grace, Joseph T. Roffy and Sarah K. Singer, all of 17 Battery Place, New York, N. Y. The company proposes to manufacture and deal in lamps, lenses, electrical and gas fixtures.

The Neuland Electrical Company, of New York, N. Y., has been granted a charter with a capital stock of $100,000 for the purpose of carrying on research work in electrical and other sciences. The incorporators are: H. S. Gould, A. W. Britton and J. M. Sullivan, 37 Wall Street, New York, N. Y.

Trade Publications

Transformers.—Bulletin No. A4144 of the General Electric Company refers to Type H, Form K subway transformers.

Motors.—"Some Installations of Watson Motors" is the title of a thirty-two-page illustrated booklet being sent out by the Mechanical Appliance Company, Milwaukee, Wis.

Indirect Lighting Fixtures.—Catalog C of the National X-Ray Reflector Company, Chicago, Ill., contains illustrations and brief descriptions of the entire line of "Eye Comfort" fixtures for indirect lighting.

Magnetos.—The Bosch Magneto Company, Forty-sixth Street and Broadway, New York, has published an eight-page illustrated pamphlet setting forth a method for adapting the Bosch magneto to Ford cars.

Batteries and Flashlights.—The American Carbon & Battery Company, East St. Louis, Ill., has issued Catalog No. 100. Within its twelve pages are illustrated and briefly described tubular miners' and coat flash-lamps, bag-type dry batteries, dry cells and other appliances.

Gas Engines.—An illustrated eight-page bulletin—No. 1—issued by the Mesta Machine Company, Pittsburgh, Pa., tells about its gas engines for all classes of service, in sizes from 350 hp upward. The design, characteristics and special features of this apparatus are clearly set forth.

Seamless Insulation.—The Hazard Manufacturing Company, of Wilkes-Barre, Pa., distributed a booklet at the recent Nashville convention of the Railway Signal Association in which it described its method of applying seamless insulation to wires. The seamless process has been questioned, but the Hazard company claims that this result is attributable to careless methods of manufacture and not to any inherent defect in the process.

Belt Dressing.—In a ten-page pamphlet recently issued by the Cling-Surface Company, 1032 Niagara Street, Buffalo, N. Y., under the title "Comparative Tests of Belts With and Without Cling-Surface," Mr. Robert Thurston Kent gives a report of a test made to determine the relative pulling power of treated and untreated belts at different arcs of contact on the pulley and at varying tensions on the belts. A number of curves illustrate the text.

Fuses.—Schweitzer & Conrad, 1770 Wilson Avenue, Chicago, have issued Bulletin No. 1, devoted to high-potential fuses. These fuses are of the indoor and weatherproof types, with mountings for all conditions of installations at electromotive forces up to 110,000 volts. Illustrations of a number of 33,000-volt transformer installations with S. & C. fuses are shown. These devices are fully described and illustrated, and a price list of various types is given.

Household Appliances.—The Hotpoint Electric Heating Company, Ontario, Cal., is sending out a broadside which contains a fac-simile of its double-page advertisement in a weekly publication of general circulation. It contains the suggestion to "shop early" and to give the "ideal gift"—a "Hotpoint" electric appliance—for a Christmas remembrance. The poster is intended for dealers, who are urged to make a display of Hotpoint devices in their windows.

New "Baby" Stimulator.—The National Quality Lamp Division, Cleveland, has published the first issue of the *National Miniature Mazdafier*. It contains fourteen pages of helpful sales ideas and a useful table giving lamp data for standard 1913 model American motor cars. The new publication will be issued monthly for the dissemination of information on miniature tungsten-filament lamps for the benefit of National Quality salesmen, agents and customers and the larger garage owners in the country.

An Electrical Primer.—The Educational Bureau of the New York Edison Company has issued an attractive twenty-six-page booklet, entitled "Electricity in the Home," which contains much practical and interesting information. Included in the contents are definitions of the more general electrical terms, how to read the meter, a list showing the economy of electricity—as, for instance, what it costs to run a vacuum cleaner for an hour—and other similar information, the use and care of cooking appliances and some chafing-dish recipes.

Personal Mention

Mr. Fred L. Hunt has been appointed chief engineer of the Greenfield (Mass.) Electric Light & Power Company.

Mr. Clyde Ketcham has succeeded Mr. Harry Chamberlain as superintendent of the municipal electric lighting plant at Weatherly, Pa.

Mr. T. M. Davis has been appointed contract agent for the Merchants' Lighting Company, Little Rock, Ark., succeeding Mr. M. A. Cohn.

Mr. A. H. Maynard has succeeded Mr. L. H. Reeves as chief engineer at the power plant of the Merchants' Lighting Company, Little Rock, Ark.

Capt. Elisha G. Abbott of the United States Signal Corps has been designated by General Barrie as acting signal officer of the Department of the East.

Mr. G. M. Lucas is the superintendent of the municipal electric-light plant of Hope, Kan., succeeding Mr. R. A. Whitenack, who resigned some time ago.

Mr. H. M. Hobart, of the General Electric Company, returned from England on the S. S. *Baltic* on Oct. 25 after an absence abroad of two and one-half months.

Mr. J. H. Mathison has recently been appointed superintendent of the municipal electric-lighting plant at Hardwick, Minn., succeeding W. T. Murray, deceased.

Mr. Thomas E. Murray, vice-president of the New York Edison Company, was the subject of a sketch in the magazine section of the *Booklyn Daily Eagle* of Oct. 26.

Mr. Amos S. Musselman, of Grand Rapids, Mich., a director in several of the power companies of Michigan, is being urged by his friends to become a candidate for Governor of Michigan on the Republican ticket.

Mr. W. C. Callahan, formerly of the Rochester (N. Y.) Railway & Light Company, has been appointed general superintendent of the Helena (Mont.) Light & Railway Company as successor to Mr. W. C. Sharp, resigned.

Mr. W. C. Sharp, general superintendent of the Helena (Mont.) Light & Railway Company, has resigned to engage in business in Des Moines with Mr. H. E. Teachout, a capitalist of that city. Mr. Sharp's successor is Mr. W. C. Callahan.

Mr. D. O. Vaughn, formerly sales representative for the F. Bissell Company, Toledo, Ohio, has recently been appointed manager of the Union City (Ind.) Lighting Company, which has been acquired by the Albert Emanuel Company of Dayton, Ohio.

Mr. J. A. Bell, of Dayton, Ohio, and Mr. Thomas A. Green, of Columbus, Ohio, both operators of telephone companies, were presented with gold medals by Governor Cox of Ohio for sticking to their posts during the March floods and keeping the wires open.

Mr. W. J. McDowell, secretary of the Chicago Section of the Electric Vehicle Association of America and one of the best-known electric-vehicle men in that city, has resigned from the Chicago staff of the General Vehicle Company and joined the forces of the General Motors Truck Company. He will be electric-truck salesman for the latter company in Chicago and vicinity hereafter.

Lieut. Col. Samuel Reber of the United States Signal Corps, recently signal officer of the Department of the East, has been appointed chief of the new bureau of aviation in the War Department. Heretofore the direction of all matters connected with aviation and aeronautics has been in the hands of the chief signal officer, Gen. George P. Scriven, assisted by Major C. McKay Saltzman.

Mr. A. E. Grant, managing director of the Canadian British Insulated Company, Ltd., Montreal, Quebec, has been elected president of the company as successor to his brother, Mr. Lawford Grant, who has entirely severed his connection with the company. As announced in these columns on June 14, 1913, Mr. Lawford Grant has joined the staff of the Eugene F. Phillips Electrical Works, Ltd., of Montreal, Que.

Mr. Howard R. Sargent, managing engineer of the wiring supplies department of the General Electric Company and a graduate of the Massachusetts Institute of Technol-

ogy, is a candidate for alderman on the Citizens' ticket in Schenectady, N. Y. Mr. Sargent, who is well known in electrical contracting and engineering circles, has been connected with the General Electric Company for twenty years and is a member of the American Institute of Electrical Engineers.

Mr. E. N. Hurley, president of the Hurley Machine Company, manufacturer of the Thor electric washing machine, was informally asked to accept the position of comptroller of the currency by Secretary McAdoo, but owing to business connections declined the tentative offer.

Mr. W. H. Richardson, for twenty-seven years superintendent of the Glenwood Light & Water Company, Glenwood Springs, Col., has retired from active service and moved to Nashville, Tenn. No successor has been named, and Mr. Richardson's duties, including purchasing, will for the present be looked after by the general manager of the company, assisted by Mr. W. M. Tait, assistant superintendent in charge of the power station, and Mr. F. W. Kaiser, assistant superintendent in charge of the distribution system and house-wiring department.

Dr. Hollis Godfrey, chief of the bureau of lighting of the city of Philadelphia, has been elected president of the Drexel Institute of Art, Science and Industry of Philadelphia. Dr. Godfrey was born in Boston, Mass., forty years ago and was educated at Tufts College, the Massachusetts Institute of Technology and Harvard University. He organized the department of science in the High School of Practical Science in Boston, spent six years in night-school work in that city and was also one of the organizers of the Garland School, the policy of which in the teaching of science and in extension work he directed for the space of two years.

Mr. J. H. Hanna, chief engineer in charge of all construction and maintenance of the Capital Traction Company, Washington, D. C., was elected president of the American Electric Railway Engineering Association at its convention in Atlantic City on Oct. 17. Mr. Hanna was born in Henderson, Ky., in 1871 and was graduated from Princeton University in 1892 with the degree of C.E. For two years after leaving college he was engaged in steam railroad engineering work and then entered the service of the Washington & Georgetown Railroad Company, predecessor of the present Capital Traction Company. He was appointed assistant superintendent of the traction company in 1895 and became superintendent and assistant engineer in 1899. He was appointed to his present position in 1908.

Mr. D. A. Hegarty, general manager of the railway and lighting departments of the New Orleans (La.) Railway & Light Company, was elected president of the American Electric Railway Transportation & Traffic Association at its recent convention in Atlantic City. Mr. Hegarty was born in Philadelphia and was educated at the University of Pennsylvania. For six years he was an assistant engineer on construction and maintenance work in the engineering department of the Pennsylvania Railroad and left the railroad company to become engineer in charge of the Richmond (Va.) Electric Railway, which was the first commercially successful electric road in America. Subsequently he became general manager and chief engineer of the company, and when the property was taken over by the Union Traction Company Mr. Hegarty became chief engineer of the Norfolk (Va.) Railway. This position he resigned shortly afterward in order to accept the post of superintendent of the Railways Company General, a holding and operating company. In 1908 Mr. Hegarty joined the operating forces of Ford, Bacon & Davis as general manager and treasurer of the Little Rock (Ark.) Railway & Electric Company. This position he resigned in 1911 to accept his present post at New Orleans.

D. A. HEGARTY

Mr. Charles N. Black, who was elected president of the American Electric Railway Association at its convention in Atlantic City on Oct. 16, was born in New York City in 1867. He was graduated from Princeton University in 1888 with the degree of A.B. and received the degree of E.E. after a two-year graduate course in electrical engineering at the same university. Immediately after his graduation he entered the employ of the Brush Electric Company in Cleveland, of which company he afterward became superintendent and general electrician. He resigned from the Brush company to take charge of the New Haven (Conn.) branch of the Walker Manufacturing Company of Cleveland, and in 1899 he became connected with the Westinghouse Electric & Manufacturing Company. Leaving the Westinghouse company, he became connected with the consulting engineering firm of Ford, Bacon & Davis and went to Kansas City in 1902 to supervise the reconstruction work of the Metropolitan Street Railway of that city. The work was completed the following year and Mr. Black was induced to continue in Kansas City as chief engineer of the company. On Jan. 1, 1905, he accepted the position of vice-president and general manager of the operating company and became vice-president of the Kansas City Railway & Light Company and also vice-president of the Kansas City Electric Light Company. The latter company is controlled by the former, which is a holding company. In September, 1907, Mr. Black accepted the position he now holds as vice-president and general manager of the United Railways of San Francisco. He is also a director of the company as well as a director and vice-president of the Sierra & San Francisco Power Company. The latter company is the successor to the Stanislaus Electric Power Company and the Tuolumne Water Power Company and is affiliated with the United Railways Investment Company. In March, 1912, Mr. Black became president of the Monterey & Pacific Grove Railway and also president of the Coast Valleys Gas & Electric Company, which was organized to effect the consolidation of several lighting properties furnishing service to Pacific Grove, Monterey, Salinas, King City and other places in California. In July, 1912, Mr. Black was elected a member of the firm of Ford, Bacon & Davis.

CHARLES N. BLACK

Obituary

Charles Augustus Chapin, president of the Indiana & Michigan Electric Company, of South Bend, Ind., died at his home in Chicago on Oct. 22, as briefly noted last week. Mr. Chapin was born in Edwardsburg, Mich., in 1845, but while he was very young his parents moved to Niles, Mich., and Mr. Chapin made his home there until fifteen years ago, when he removed to Chicago. He had been ill for about two months and died of heart disease. In early life the decedent was associated in business with his father, Mr. Henry A. Chapin, and together they established the South Bend Electric Company in 1883. Out of this company grew the present Indiana & Michigan Electric Company, which develops about 25,000 hp, principally in hydroelectric plants in northern Indiana and southern Michigan. This company was organized by Mr. C. A. Chapin and has water-power plants along the St. Joseph River at Elkhart and Mishawaka, Ind., and Buchanan and Berrien, Mich. It also maintains a steam generating plant, normally held as a reserve, at South Bend, where the general offices of the company are located. Mr. Chapin was a man who avoided publicity and, although connected with the electric-service industry for thirty years, was not widely known among electrical men. He was, however, a man of quick wit, fond of a joke and was highly regarded by his associates. He was a member of the Union League, Glen View, Chicago Yacht and other clubs.

Construction

New England

MIDDLETON, MASS.—At a special town meeting held Oct. 15 the Selectmen were authorized to issue bonds to purchase the electric plant of the Middleton El. Lt. Co., to be owned and operated by the municipality.

NORTH ABINGTON, MASS.—At a meeting of the stockholders of the El. Lt. & Pwr. Co. of Abington and Rockland to be held Nov. 7 the stockholders will be asked to authorize the directors to petition the State Board of Gas and Electric Light Commissioners for permission to issue 472 additional shares of capital stock.

NARRAGANSETT PIER, R. I.—The Narragansett Pier El. Lt. & Pwr. Co. is considering extending its transmission lines to Kingston (a distance of 2½ miles), the location of the Rhode Island State College. W. C. Clarke is general manager.

HARTFORD, CONN.—The Young Men's Christian Association is planning to build a new building, to cost about $225,000, bids for construction of which will be received Nov. 8. The cost of equipment is estimated at $25,000 (for which bids will be asked in March) and will include two horizontal tubular boilers of 125 hp each, two electric elevators, two ventilating fans and motors. Shattuck & Hussey, 19 South La Salle Street, Chicago, Ill., are architects. G. C. Herbert is general secretary.

Middle Atlantic

CENTRAL ISLIP, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, N. Y., until Nov. 7, for additional electric generating equipment at Central Islip State Hospital, Central Islip, N. Y. Drawings and specifications may be consulted and blank forms of proposals obtained at the Central Islip State Hospital, at the office of the State Hospital Commission, 1 Madison Avenue, New York, and at the office of Lewis F. Pilcher, state architect. Complete plans and specifications may be obtained upon application to the state architect.

GREECE, N. Y.—The Town Board has entered into a contract with the Rochester Ry. & Lt. Co., of Rochester, for a new lighting contract, under which the Charlotte Boulevard will be lighted from the city line to Charlotte, the Ridge Road to the railroad, and Dewey Avenue to Barnard. All the cross streets will also be illuminated. The contract calls for the installation of 300 incandescent lamps. Post office address is Greece, R. F. D. Barnard.

NEW YORK, N. Y.—The contract for furnishing and installing lighting fixtures in the Municipal Building has been awarded to the Edward Schroeder Lamp Works, 200 Fifth Avenue, New York, N. Y., at $44,273.

WEEDSPORT, N. Y.—Bids will be received by the Board of Trustees of the village of Weedsport until Nov. 8 for the construction and installation of an electric-light plant, together with a producer-gas engine and suction-gas producer for operating plant. Bids may be submitted for the whole work or a unit thereof, as specified in the plans and specifications on file with the village clerk or at the office of F. M. Parsons. C. D. Van Alstine is village clerk

CHAMBERSBURG, PA.—The city of Chambersburg expects to install in the municipal electric-light plant within the next three months the following equipment: One 625-kva, three-phase, 60-cycle, 2300-volt Curtis turbo-generator set, complete with condensers, etc.; one 375-kva, three-phase, 60-cycle, 2300-volt belted set; two 75-hp, three-phase, 60 cycle, 2300-volt motors and three 50-lamp General Electric double-tube rectifier sets; also within the next 30 days to erect a nine-panel switchboard. J. H. Mowrey is superintendent.

EMPORIUM, PA.—The municipal electric-light commission expects to purchase within the next six months a 150-hp engine, generator and exciter and lamp-posts. C. E. Crandell is secretary and W. W. Knickerbocker is engineer.

INTERCOURSE, PA.—The Intercourse El. Lt., Ht. & Pwr. Co. expects to erect 4 miles of 2300-volt transmission lines. The company has completed its substation and expects to close its present steam-power plant in a few days and connect with the Edison El. Co.'s 11,000-2200-volt transmission line. Enos L. Zimmerman is secretary and treasurer.

LOYSVILLE, PA.—The Sherman's Valley Lt., Ht. & Pwr. Co., of Loysville, expects to install within the next month one 25-hp oil engine to supplement turbine waterwheel. C. A. Widle is treasurer and manager.

OIL CITY, PA.—The Citizens' Lt. & Pwr. Co., of Oil City, expects to install within the next two months one 1500-kw turbine and two 500-hp boilers, automatic stokers for all boilers and new condensers for turbine. Material and equipment for above improvements have been purchased. The company has just completed the reconstruction of 12 miles of 11,000-volt transmission line to Franklin. W. W. Cole is acting general manager.

PHILADELPHIA, PA.—The contract for installing electrical equipment on the Dock Street pier has been awarded to the Thompson El. Co., 1606 Sansome Street, Philadelphia. The company was also awarded the contract for electrical equipment for the physical and chemical laboratory to be erected in Altoona for the Pennsylvania Railroad.

SCRANTON, PA.—The United Service Co., of Scranton, expects to install an additional 500-hp boiler at its Coshocton (Ohio) plant; one 1500-kw turbine at its Warren (Pa.) plant, also two 250-hp boilers within the next six months. The company also expects to erect 30 miles of 33,000-volt transmission lines in Ohio and 13 miles of 13,500-volt lines in Pennsylvania within the next six months; also material for the above transmission lines. L. H. Conklin, of Scranton, is secretary and manager.

BURLINGTON, N. J.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 1, for construction complete, including mechanical equipment, interior lighting fixtures and approaches, of United States post office at Burlington, N. J. Drawings and specifications may be obtained from the custodian at Burlington, N. J., or from the above office. O. Wenderoth is supervising architect.

WILLIAMSON, W. VA.—The Williamson Lt. & Ice Co. expects to purchase a 100-hp to 125-hp, 60-cycle, two-phase, 2200-volt motor, speed not over 500 r.p.m.

BRISTOL, VA.—Negotiations have been closed between Benjamin L. Dulaney, of Bristol, Va., and Samuel Insull, of Chicago, Ill., whereby the latter will take over the entire property of the Electric Transmission Co., which includes a large power plant erected at the pit mouth of the coal deposits in southwest Virginia. It is understood that the deal will result in the expenditure of several million dollars on the erection of a plant and transmission lines to transmit electricity to various parts of the country. It is also proposed to supplement the hydroelectric plants in dry seasons. The purpose of Mr. Dulaney was to transmit electricity to the Atlantic seaboard, reaching the large factories in the Piedmont region. Mr. Insull, it is said, proposes also to carry electricity westward across Kentucky into Cincinnati, Chicago and other Western cities.

LYNCHBURG, VA.—The Lynchburg Trac. & Lt. Co., it is reported, will install an additional generating unit at its power plant in Reusens, increasing the output of the plant by 1350 hp. Contracts for equipment have been awarded.

North Central

CADILLAC, MICH.—The Western Michigan Pwr. Co., a subsidiary of the Commonwealth Pwr. Co., has petitioned the Supervisors of Wexford County for permission to construct dams across the Manistee River for power purposes as follows: At Yuma, a 30-ft. dam; at Mesick, a 27-ft. dam; at Sherman, a 60-ft. dam; at Buckley, a 50-ft. dam; at Mystic, a 60-ft. dam; at Manton, a 47-ft. dam; at Baxter, a 35-ft. dam, and at Walton, a 65-ft. dam. The company agrees to furnish electricity in Cadillac at a maximum rate of 9 cents per kw-hr. Plans have been prepared by the company for the construction of a 65-ft. dam at a point where the Pine River flows into the Manistee River. Electricity generated at this plant will be transmitted to Cadillac.

DETROIT, MICH.—The Public Lighting Commission has awarded a contract to the Westinghouse El. & Mfg. Co., of Pittsburgh, for one 500-kw, two-phase, 2200-volt turbo-generator set. Contracts for 19 75-lamp regulators for luminous-arc circuits and lamps, cable, wire and poles, and practically for all supplies that will be required for extensions of the system this fiscal year, have been awarded. F. Mistersky is general superintendent.

EATON RAPIDS, MICH.—The Board of Public Works expects to erect within the next two months 2 miles of three-phase distribution lines (changing from single-phase to the three-phase system), also to purchase within the next year electrically driven pumps and to purchase 300 ft. or 400 ft. of underground cable within the next six months, and to install ornamental lamps on about four blocks; also to purchase electrical appliances and supplies with a view to building up a day load. Within the next three months it expects to purchase some transformers, the number required or horse-power not yet decided upon. I. R. Ellison is superintendent.

HOLLY, MICH.—The Village Council has awarded the contract for street-lighting to the Independent Pwr. Co. for a period of ten years. The contracts provide for the maintenance of 70 lamps.

KALAMAZOO, MICH.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 27 for a conduit and wiring system and lighting fixtures in the United States post office, Kalamazoo, Mich. For details see proposal columns.

CHICAGO JUNCTION, OHIO.—The Board of Public Affairs expects to purchase within the next 30 days lighting fixtures for a public building, the cost not to exceed $275. E. K. McMorris is clerk of Board of Public Affairs.

COLUMBUS GROVE, OHIO.—The Board of Public Service expects to purchase within the next six months three new boilers, one 250-hp engine and generator, with exciter and one switchboard, for the municipal electric-light plant. Earl Anderson is superintendent of municipal plant.

COSHOCTON, OHIO.—The Lafayette Lt. & Power Co. has been granted permission by the Public Utilities Commission to issue $10,000 in capital stock, the proceeds to be used to reimburse the incorporators for expense of organization and the amount expended for engineering services, securing rights-of-way, etc., to the amount of $2,511, the remainder to be used to purchase the right-of-way and for construction and equipment of a transmission line from the power house in Coshocton to the village of West Lafayette.

MIDDLEPORT, OHIO.—The County Commissioners have granted Richard Ellis a 20-year franchise to extend the present street-car system from the Middleport corporation line to the K. & M. tracks at Dobson. The franchise includes the privilege of building a power house in that vicinity.

NORWALK, OHIO.—Plans have been submitted to the City Council estimating the cost of installing an electric-light plant. One plan provides for the installation of an electric plant in connection with the municipal water-works system and erection of distribution lines throughout the city, at a cost of $103,000; the second plan is to erect a distribution system only and to purchase electricity, which would cost only about half as much as the first proposition. The Cleveland, Columbus & Southwestern Ry. Co. now furnishes electrical service in the city.

SALEM, OHIO.—The electric-lighting system is being extended on three streets; improvements are also being made in the power plant. D. H. Rummell is service director.

SPRINGFIELD, OHIO.—Of the proceeds of the $2,500,000 bond issue by the Springfield Ry. Co., $500,000 will be used to retire outstanding bonds to the amount of $500,000 and the remainder for improvements to its service. The power plant is to be enlarged, new carhouses erected and street railway lines extended.

LEITCHFIELD, KY.—The plant of the Leitchfield El. Lt., Ht. & Pwr. Co. was destroyed by fire on Oct. 25, causing a loss of $15,000. Work, it is said, will begin at once on reconstruction of the plant.

LOUISVILLE, KY.—The firm of Hardin & Palmer, of Louisville, furniture manufacturers, has decided to use electricity to operate its plant instead of rebuilding its steam-power plant, which was recently destroyed by fire. Orders have been placed by the company for 14 motors, ranging from 2 hp to 15 hp. The company has contracted with the Louisville Gas & El. Co. for electrical service.

WHITESBURG, KY.—The city of Whitesburg will soon advertise a sale of an electric-light franchise. The ordinance will be submitted to the voters on Nov. 4. C. H. Burton is engineer.

LA GRANGE, IND.—The La Grange County El. Lt. & Pwr. Co. expects to erect within the next eight months about 10 miles of 6600-volt transmission lines in connection with extending its La Grange line to Wolcottville; also to purchase within the next six months transformers, lightning arresters, insulators, wire, meters, tub transformers, incandescent lamps, etc. The La Grange County Lt. & Pwr. Co. has taken over the plant and holdings of the La Grange El. Lt. Co. L. G. Young is superintendent.

MOHAWK, IND.—The installation of an electric-light system in Mohawk is under consideration. An effort is being made to secure electricity from the Union Trac. Co., of Anderson.

MULBERRY, IND.—The Mulberry Lt. & Pwr. Co. expects soon to purchase some No. 14 National Electrical Code wire. Albert Weidner is secretary.

NEW RICHMOND, IND.—The Montgomery Lt. & Pwr. Co. expects to erect within the next two months 20 miles of transmission lines and distribution systems in Linden, New Richmond and Wingate.

SHERIDAN, IND.—The Sheridan Wtr., Lt., Ht. & Pwr. Co. expects to purchase within the next six weeks a 10-ton ice plant (to be operated by exhaust steam) in connection with the water and light plant.

BATAVIA, ILL.—Plans are being considered by the Batavia Commercial Club for the extension of the ornamental street-lighting system.

CAMBRIDGE, ILL.—The property of the Cambridge El. Lt. & Pwr. Co. is reported to have been purchased by E. O. Brown, of Elmwood, Ill. The Village Board has granted him a 20-year franchise to operate an electric-light system here. Mr. Brown has acquired plants at Altoona, Oneida, Galva and Lafayette, and is reported to have secured options on the plants in Toulon, Woodhull and Geneseo. The systems, it is understood, will be consolidated and energy supplied from a central station to be located at Galva.

ELGIN, ILL.—At an election held recently the proposition to issue $162,000 in bonds for the construction of an electric-light plant was carried.

HILLSBORO, ILL.—Franchises have been granted to the Southern Illinois Lt. & Pwr. Co., of Hillsboro, for extensions of its system into Mulberry Grove, Panama and Donnellson. Preparations are being made by the company to erect a 33,000-volt transmission line from Hillsboro to Greenville to furnish electricity in the villages where franchises have been granted, and also in Greenville.

MANITO, ILL.—Plans have been prepared by Reeves & Baill, of Peoria, architects, for the construction of a new power station for the municipal electric-light plant.

MOLINE, ILL.—The People's Pwr. Co., of Moline, is contemplating changing the present street-lighting system to magnetite-arc lamps.

MOLINE, ILL.—Bids will be received by the Board of Education of Moline until Nov. 4 for the installation of a lighting system, sanitary and plumbing system and a heating system for the new high school building. Plans and specifications can be seen at the office of Eckland & De Arment, architects, of Moline, and at the office of Normand S. Patton, Holmes & Flinn, architects, of Chicago, Ill. Bonds to the amount of $200,000 were voted for the building.

MULBERRY GROVE, ILL.—The Village Board has granted the Southern Illinois Lt. & Pwr. Co., of Hillsboro, a 50-year franchise to operate an electric-light system here. The company was also awarded a contract for lighting the streets of the village for a period covering 10 years.

STERLING, ILL.—The City Council has appropriated $2,500 toward the installation of a new street-lighting system in Sterling. Funds, it is reported, have been raised for the installation of ornamental lamps on 18 blocks in Sterling. The Commercial Club is promoting the project.

ANTIGO, WIS.—A proposition for improving the present street-lighting system has been submitted to the City Council by the Antigo El. Co. The plans provide for the installation of an ornamental street-lighting system on Fifth Avenue, consisting of 15 Luxolabra lamp standards carrying inverted arc lamps; also replacing the present street lamps in the residence districts with tungsten incandescent lamps. The initial cost of installing lamps on Fifth Avenue is estimated at $1,700.

LA CROSSE, WIS.—The La Crosse Gas & El. Co. (controlled by the American Public Utilities Co.) is making extensive improvements to its property, including gas, electric-light and hot-water-heating service, involving an expenditure of $157,600. These improvements consist of four 400-hp new water-tube boilers, four automatic stokers with new machinery, two steel stacks for the new boilers, 160 ft. high by 72 in. in diameter, new larger steam piping for the central-station heating plant, new feed-water heater and purifier, coal and ash-handling machinery, steam turbine, centrifugal pump, new device for heating water with exhaust steam, new hot-water piping, changes in electrical apparatus, increasing the capacity of the heating and electrical department at its Edison station, new 1000-kw generating unit to take care of the growing electric load, rearrangement of switchboards, circuit regulators, etc., and enlarging buildings to provide space for new boilers and generating machinery. Paul Leake, of Grand Rapids, is publicity manager of the American Public Utilities Co.

MANITOWOC, WIS.—An ordinance providing for a bond issue of $150,000 for the purchase of the electric-light plant (the valuation of which is pending before the rate commission) has been introduced in the City Council.

BIWABIK, MINN.—A franchise, it is reported, has been awarded to the St. Louis Pwr. Co., a subsidiary of the Northern Pwr. Co., of Duluth, to furnish electricity for lamps and motors here.

DULUTH, MINN.—A movement has been started by John J. Frey, Judge H. W. Lanners and other business men of West Duluth for the installation of an ornamental street-lighting system on three streets.

MINNEAPOLIS, MINN.—Bids will be received by the Board of County Commissioners of Hennepin County, at the office of the county auditor, Minneapolis, until Nov. 3 for electric wiring all the buildings at the county farm, in accordance with specifications on file in the office of the county auditor. A. P. Erickson is county auditor.

ALBIA, IA.—The City Council has engaged Arthur M. Morgan, consulting engineer, Harris Trust Building, Chicago, Ill., to prepare plans and estimates of cost of the installation of a municipal electric-light plant.

ANAMOSA, IA.—At a special election held recently it was voted to award the Anderson Pwr. Co.'s franchise to parties building the Iowa City-Cedar Rapids Interurban railway. The new owners will make extensions and improvements to the system. The new company will be known as the Anamosa Lt. & Pwr. Co. Col. W. G. Dows, I. Smith and J. F. Reed are interested in the new company.

APLINGTON, IA.—Work has begun on the installation of an electric-light plant in Aplington.

DYSART, IA.—The contract for the construction of the municipal electric-light plant has been awarded to the Alamo Engine & Supply Co., of Omaha, Neb., for $12,809, which includes the construction of power plant and erection of overhead distribution system. The Western El. Co., of Chicago, Ill., was awarded the contract for transformers, at $481. The contract for power station has not yet been awarded.

INDEPENDENCE, IA.—The commissioners of the water and light plant expect to purchase two 150-hp fire-tube boilers within the next two months. George D. Warren is manager.

CALIFORNIA, MO.—The California El. Lt. & Pwr. Co. expects to install within the next eight months one 150-hp boiler, one 125-hp engine and a 100-kw generator. In July the company changed its system from 133 cycles to 60 cycles, three-phase, and established a 24-hour service. A 150-kva, 60-cycle, three-phase generator was installed, replacing a 60-kw, 133-cycle machine. F. T. Porter is owner and manager.

CANTON, MO.—The municipal electric light commission expects to purchase within the next four months one 50-kva to 100-kva, 60-cycle, 2200-volt alternator and a 75-hp to 150-hp Corliss engine (both second-hand) for the municipal electric-light plant. W. Dusenderry is manager.

HAMILTON, MO.—A committee, consisting of Aldermen Whiteman and Arey, has been appointed by the City Council to look into the proposition submitted by Messrs. Miller and Gilber for the construction of a new electric-light plant, installing a system of water-works and the erection of an electric transmission line from Hammond to Kingston.

LEWISTOWN, MO.—The managers of the Lewistown mill and electric-light plant expect to purchase within the next five months a 100-hp or 200-hp oil or gas engine for connection to a 45-kw Fort Wayne direct-current generator (belt-driven). A 125-hp Brownell steam engine is being used. J. S. Heavenridge is superintendent.

DRAKE, N. D.—Application has been made to the Board of Trustees by George Todd, of Minot, for a franchise to construct and operate an electric-light plant in Drake.

AUBURN, NEB.—Bids will be received by I. H. Kuper, city clerk, until Nov. 17 for furnishing material and construction of municipal electric-light plant and extensions to water-works system. For details see proposals columns. G. E. Johnson, of Falls City, is engineer and Church Howe is Mayor.

BEAVER CROSSING, NEB.—The Beaver Crossing Lt. & Pwr. Co. expects to purchase within the next two months transformers and meters. L. G. Gake is secretary.

COLUMBUS, NEB.—Arrangements are being made by Willis Todd, 214 First National Bank Building, Omaha, and associates for the construction of a hydroelectric power plant on Birdwood Creek, Lincoln County. The initial installation will provide for 500 hp, which later will be increased to 1500 hp. Transmission lines will be erected to serve the towns of Sutherland, Hershey and North Platte, Neb., and also the Union Pacific and Burlington railroads.

EXETER, NEB.—The Exeter El. Lt. & Pwr. Co. expects to install within the next two months a 125-hp tubular boiler, a 11-in. by 18-in. baby Corliss engine and a 45-kw, 125-volt direct-current generator (700 r.p.m.) in the municipal electric-light plant. Equipment has already been purchased.

HAMPTON, NEB.—The Board of Trustees expects to purchase within the next four months one carload of poles for use in connection with the municipal electric-light plant. William C. Paschke is clerk.

HEBRON, NEB.—The managers of the municipal electric-light plant are contemplating the installation of a street-lighting system within the next six or eight months. O. P. Hess is superintendent.

SILVER CREEK, NEB.—Negotiations have been closed whereby the village will take over the local electric-light plant, to be owned and operated by the municipality.

HOPE, KAN.—The managers of the municipal electric-light plant expect to install three single-pole knife-blade switches. G. M. Lucas is superintendent.

PROTECTION, KAN.—Bonds to the amount of $30,000 have been voted for the purchase of the local electric-light plant and the installation of a water-works system.

Southern States

DURHAM, N. C.—The Durham Trac. Co. has recently purchased two 350-hp Stirling boilers and smokestack for immediate installation; also 100 kva in transformers for improving the city service. R. L. Lindsey is general manager.

NEWBERRY, S. C.—Bonds to the amount of $30,000 have been voted for the purchase of the electric-light plant and water-works system now in course of construction.

CALHOUN, GA.—The city of Calhoun has recently installed a new boiler, pump and dynamo in the municipal electric-light and water plant.

MARSHALLVILLE, GA.—The city of Marshallville contemplates the construction of an electric-light plant, to cost about $15,000. The present plans provide for a 75-hp development (steam power) and about 28 miles of wiring for the distribution system. J. C. Bouten is Mayor.

MILLEN, GA.—The manager of the municipal electric-light and water plant expects to purchase within the next few months a new boiler (16 ft. by 5 ft. 6 in.). H. B. Davis is manager.

STILLMORE, GA.—The Stillmore El. Lt. Co. expects to erect within the next 30 days ½ mile of feeder line to suburban homes. Within the next six months the company expects to purchase a 60-hp boiler, a 35-hp or 40-hp engine and an alternating-current generator; it also expects to purchase some meters within the next 12 months. W. L. Clark is owner.

JONESBORO, ARK.—The Board of Trustees of the State Agricultural College has decided to rebuild the power plant recently destroyed by fire. Arrangements have been made with the city plant to furnish electrical service until the plant is finished.

BATON ROUGE, LA.—Bids will be received by the water and lighting committee until Nov. 22 for lighting the city of Baton Rouge with electricity for a period of five years, beginning April 2, 1914, with not less than 150 to 200 lamps. Plans and specifications are on file at the city hall, copies of which may be obtained upon application to the water and lighting committee. Philip P. Huyck is chief of police.

FAIRLAND, OKLA.—The Fairland Lt. & Pwr. Co. expects to purchase within the next four months one 30-kw generator and to install storage batteries to maintain 50 house lamps. L. H. Long is manager.

GOLIAD, TEX.—The entire plant of the Goliad Wtr., Lt. & Pwr. Co. was recently destroyed by fire, causing a loss of about $25,000. The town at present is without water or light service. E. F. Glaze is president and manager.

HURLEY, TEX.—The Western Pwr. Co., recently organized, is planning to install an electric plant in Hurley for the purpose of furnishing energy to pump water for irrigation purposes in the Hurley Valley. Orders have been placed for three 400-hp engines. The company is capitalized at $40,000.

Pacific States

CASHMERE, WASH.—The contract for installing 121 lamps in the business and residence districts in Cashmere has been awarded to Le Page, McKenna & Co., of Seattle.

CENTRALIA, WASH.—The Washington Pub. Ser. Corpn., of Olympia, has applied to the Commissioners of Lewis County for a franchise to construct and operate electric transmission lines from Chehalis to Centralia and from Centralia to the north county line toward Olympia. Milliard Lemo and Wilbur B. Forshay are interested in the company.

EDMONDS, WASH.—The Edmonds El. Lt. & Pwr. Co., of Edmonds, has applied to the Commissioners of King County for a franchise to construct and operate an electric-lighting system in Richmond Beach.

ISSAQUAH, WASH.—Bids will soon be received by the city of Issaquah for lighting the streets of the city. The city has decided to use tungsten lamps for street-lighting.

LYMAN, WASH.—The Pacific Northwest Trac. Co., of Seattle, will soon begin work on the erection of electric transmission lines into Lyman. Transmission lines will also be erected into Hamilton.

OLYMPIA, WASH.—The Washington Pub. Ser. Corpn. has petitioned the Commissioners of Thurston County for permission to erect a transmission line from Olympia to Tenino, thence to Grand Mound and back through Rochester to Gate, to supply electricity for lamps and motors. Milliard Lemon and Wilbur B. Forshay are interested in the company.

POMEROY, WASH.—The Pacific Pwr. & Lt. Co., of Portland, Ore., has applied to the City Council for a franchise in Pomeroy for a period of five years.

SEATTLE, WASH.—The Puget Sound Trac., Lt. & Pwr. Co., of Seattle, is reported to have acquired a power site on the Baker, where a power plant will be erected in the near future.

SEATTLE, WASH.—Plans and estimates have been submited to the Council by the city engineer for the installation of cluster lamps on Fifth Avenue from Virginia Street to Denny Way, to cost about $17,000.

SPOKANE, WASH.—The special committee appointed by the City Council to investigate the proposition of establishing a municipal electric-light and power plant has recommended that Burns & McDonnell, of Kansas City, Mo., be retained as consulting engineers.

ASHLAND, ORE.—City Electrician Butterfield has recently recommended to the City Council that the proposition to issue $25,000 in bonds, the proceeds to be used for the construction of an auxiliary electric plant and extension to distribution system, etc., be submitted to the voters at the coming election.

BAKER, ORE.—The Eagle River El. Pwr. Co., of Baker, expects to purchase within the next 30 days a 500-kw, 60-cycle, 2300-volt turbo-generator set for its auxiliary plant at Baker. J. K. Romig is vice-president and manager.

CORVALLIS, ORE.—The committee appointed by the Council to investigate the proposition to secure electricity from the Oregon Pwr. Co., of Albany, for lighting the city, has reported in its favor.

LEBANON, ORE.—The Lebanon El. Lt. & Wtr. Co. expects to erect within the next three months 22 standards carrying five-lamp clusters, to be operated on 6.6-amp series system. Posts and wire have already been purchased. S. I. Stewart is manager.

PORTLAND, ORE.—The City Council has awarded the contract for lighting the streets with arc lamps and the parks and public building with incandescent lamps to the Portland Ry., Lt. & Pwr. Co. for a period of three years. The contract covers the entire city.

SHERIDAN, ORE.—The Sheridan Lt. & Pwr. Co. expects to erect within the next two months 5 miles of three-phase transmission line connecting Willamina and Sheridan. The company has purchased a switchboard and synchronizing equipment from the Westinghouse El. & Mfg. Co. J. T. Thompson is general manager.

LONG BEACH, CAL.—Contracts have been awarded by the Board of Public Works for the installation of ornamental lighting system on American Avenue from the ocean front to Anaheim Street, to K. T. Bennett, at $11,434; on Broadway from Alamitos to Water Street, to Woodill & Hulse, for $23,525, and for the interior of a comfort station at Knoll Park, to W. D. Lambert, for $495.

OROVILLE, CAL.—Notice has been filed of appropriation upon the waters of the middle fork of the Feather River and upon Fall River. The notice states that the water is to be used for the purpose of generating electrical energy. The water will have a total fall of 1000 ft. and it is estimated that 60,000 hp can be developed. The plans provide for an impounding dam, which will store 15,000,000,000 cu. ft. of water. F. G. Eby, S. H. Wisner and L. F. Breuner, of Sacramento, are interested in the project.

RIVERSIDE, CAL.—Bids will be received at the office of the city clerk, Riverside, Cal., until Nov. 20 for furnishing material, labor and constructing improvements to the water-works system, including furnishing and installing two motor-driven centrifugal pumps in each of the two pumping stations, with piping, connections, etc. (contract 5). Plans and specifications may be obtained upon application to Burns & McDonnell, consulting engineers, Kansas City, Mo. H. C. Cree is city clerk.

POCATELLO, IDAHO.—The Beaver River Pwr. Co., a subsidiary of the Idaho Lt. & Pwr. Co., of Boise, it is reported, will soon begin work on the installation of a plant here. The company was recently granted a franchise in Pocatello.

ANACONDA, MONT.—The Commissioners of Granite County have granted the Northern Pacific Ry. Co. permission to erect electric transmission line over certain portions of the county.

HARLEM, MONT.—The Town Council has engaged A. L. Jacqueth to prepare plans and specifications for a municipal electric-light plant.

Canada

WINNIPEG, MAN.—Notice is hereby given to contractors that tenders will be received early in 1914 for construction work necessary for the delivery of water from Shoal Lake to the Greater Winnipeg water district as follows: (1) A dike and channel for the diversion of the Falcon River into Snowshoe Bay; (2) 85 miles of concrete aqueduct; (3) 100 miles of pipe line; (4) 900 linear ft. tunnel under Red River; (5) 85 miles of construction railway; (6) telephone line; (7) clearing and ditching. Particulars as to the estimate of cost of the work and map of approximate location and profile of aqueduct may be obtained from M. Peterson, acting secretary of the administration board of Greater Winnipeg Water District.

BRANTFORD, ONT.—The Dominion Pwr. & Trans. Co., of Hamilton, is contemplating the construction of a power plant at Mohawk Lake to develop 2500 hp to take care of its peak load in Brantford.

PORT COLBORNE, ONT.—Arrangements are being made for the erection of a branch transmission line of the Hydro-Electric Power Commission from the new Welland-Niagara Falls line to Port Colborne.

ST. MARY'S, ONT.—The Light and Power Commission has decided to replace the present street-lighting system with ornamental standards carrying five-lamp clusters. A number of 100-cp single lamps will also be installed.

TORONTO, ONT.—The Canadian Stewart Co., which has the contract for deepening the Toronto Harbor, will operate all its machinery by electricity and has contracted with the Toronto Hydro-Electric Commission for energy. The contract calls for between 7000 hp and 8000 hp.

TORONTO, ONT.—The Toronto Hydro-Electric Commission find that instead of 13,000 services for which money was appropriated last January it has had to provide 21,000 services. With this situation to face, the commission needs some of the money that would be provided by the issue of $700,000 unauthorized debentures, and it is expected that the city will be called upon to arrange for payment. The commission is compelled to order supplies and equipment costing $250,000, and has to face the difficulty of financing the purchase with no funds.

WELLAND, ONT.—The Town Council has voted to appropriate $20,000 additional for the Hydro-Electric system in Welland. The system was recently completed, but owing to increased territory due to extension of streets additional funds are needed to extend the service. The Hydro-Electric Commission has placed an order with the Canadian General El. Co. for six transformers, each 3500-kva, 46,000-2300-volts, for use in Welland in connection with the new 46,000-volt line to be erected from Niagara Falls.

WESTON, ONT.—The Weston Water, Power and Light Commission has decided to erect a high candle-power lamp on every pole on the west side of Main Street from one end of the village to the other; also to install lamps on every pole on the east side of Main Street between King and Mill Streets.

MONTREAL, QUE.—Work has begun on the construction of a substation at Rougemont for the Montreal & Southern Counties Ry Co. This station will be equipped with a 300-kw motor-generator set, one bank of transformers, high-and-low-tension switchboards, switching apparatus, etc.

MONTREAL, QUE.—A report has been prepared by A. Parent, superintendent of the civic lighting department, recommending a new lighting scheme for St. Catherine Street in connection with the underground conduits. Mr. Parent recommends an iron standard about 14 ft. high carrying an inverted magnetite lamp; also increasing the number of lamps from 57 to 147. The report also recommends that the single lamp standards should be installed in the downtown districts as soon as the conduits are constructed.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until Nov. 3 for furnishing miscellaneous articles under Circular No. 804-A, including 12 1-kw, single-phase, 12 5-kw, single-phase, 12 10-kw, single-phase, six 15-kw, single-phase and one 20-kw, three-phase transformer, to be used on power and lighting distribution systems, and which shall be of the weatherproof pole type and be furnished complete with oil hangers and fuse blocks; 10,000 ft. No. 14 B. & S. gage, duplex, rubber-covered, 3/64-in. stranded stage cable; 10,000 ft. No. 16 B. & S. gage, duplex, rubber-covered, 3/64-in., stranded stage cable; 50,000 ft. No. 12 B. & S. gage, solid, double-braid, weatherproof copper wire; 50,000 ft. No. 14 B. & S. gage, solid, double-braid, weatherproof copper wire; 300 10-amp, 50 15-amp, 150 20-amp, 500 50-amp and 400 60-amp standard National Electric Code clip-contact, inclosed, 250-volt fuses; 2000 8-in. flat porcelain shades for 2¼-in. holder; 1000 lb. ¾-in. wide navy standard friction tape in ½-lb. rolls, packed in tin boxes. Major F. C. Boggs is general purchasing agent.

GEORGETOWN, BRITISH GUIANA.—The Demerara El. Co., of Georgetown, expects to purchase regular supplies for distribution system, including incandescent lamps, etc.; also household labor-saving devices, including vacuum cleaners, washing machines, etc. W. B. Gray is manager.

New Incorporations

LOS ANGELES, CAL.—The Molander Pwr. Co. has been incorporated with a capital stock of $1,000,000. The directors are: Arvid G. Ahn, J. S. Erickson, F. M. Shepard, A. G. Anderson, W. H. Bratton, J. B. Benjamin, H. A. Goldman, C. G. Cornell and T. E. Burns.

HONESDALE, PA.—The Browntown El. Co., of Honesdale, has been granted a charter with a capital stock of $5,000 to operate in Clinton Township.

AVA, MO.—The Ava El. Lt. Co. has been incorporated with a capital stock of $6,000 by H. S. Wilson, J. W. Petit and Joseph H. Hawkins.

Directory of Electrical Associations, Societies, Etc.

Alabama Light and Traction Association. Secretary-treasurer, H. O. Hanson, Mobile Gas Co., Mobile, Ala.

American Association for the Advancement of Science. Permanent secretary, L. O. Howard, Smithsonian Institution, Washington, D. C. Annual meeting, Atlanta, Ga., Dec. 29.

American Electric Railway Accountants' Association. Secretary-treasurer, E. B. Burritt, 29 West 39th St, New York.

American Electric Railway Association. Secretary, E. B. Burritt, 29 West 39th St., New York.

American Electric Railway Engineering Association. Secretary, E. B. Burritt, 29 West 39th St., New York.

American Electrochemical Society. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

American Electro-Therapeutic Association. Secretary, Dr. J. Willard Travell, 27 East 11th St., New York.

American Institute of Consulting Engineers. Secretary, Eugene W. Stern, 101 Park Ave., New York City.

American Institute of Electrical Engineers. Secretary, F. L. Hutchinson, 33 West 39th St., New York. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

American Physical Society. Secretary, Prof. A. D. Cole, Ohio State University, Columbus, Ohio. Annual meeting, Atlanta, Ga., December, 1913.

American Society for Testing Materials. Secretary-treasurer, Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

American Society of Heating and Ventilating Engineers. Secretary, Edwin A. Scott, 29 West 39th St., New York.

American Water Works Association. Secretary, J. M. Diven, 47 State St., Troy, N. Y. Annual meeting, May, 1914.

Arkansas Association of Public Utility Operators. Secretary, W. J. Tharp, Little Rock, Ark. Annual meeting, May, 1914.

Association of Edison Illuminating Companies. Secretary, Geo. C. Holberton, Pacific Gas & Electric Co., San Francisco, Cal.

Association of Iron and Steel Electrical Engineers. Secretary, W. T. Snyder, McKeesport, Pa.

Association of Railway Electrical Engineers. Secretary-treasurer, Jos. A. Andreucetti, Chicago & Northwestern Railway, Chicago.

Association of Railway Telegraph Superintendents. Secretary, P. W. Drew, 112 West Adams St., Chicago. Annual meeting, New Orleans, May 19-22, 1914.

California Electrical Contractors' Association. Secretary, W. S. Hanbridge, 1408 Merchants' National Bank Building, Los Angeles, Cal.

Canadian Electrical Association. Secretary-treasurer, J. H. Larmonth, 610 Confederation Life Bldg., Toronto, Can.

Colorado Electric Club. Secretary, C. F. Oehlmann. Meets every Thursday at Albany Hotel, Denver, Col.

Colorado Electric Light, Power and Railway Association. Secretary-treasurer, T. F. Kennedy, 900 15th St., Denver, Col.

Electric Club of Chicago. Secretary, Fred M. Rosseland, Monadnock Block, Chicago. Meets every Thursday noon at Hotel Sherman.

Electrical Contractors' Association of Greater Boston. Secretary, R. S. Hale, 39 Boylston St., Boston.

ELECTRICAL CONTRACTORS' ASSOCIATION OF MASSACHUSETTS. Secretary, H. D. Temple, 30 Foster St., Worcester, Mass.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, Geo. W. Russell, Jr., 25 West 42d St., New York.

ELECTRICAL CONTRACTORS' ASSOCIATION OF THE CITY OF CHICAGO. Secretary, M. N. Blumenthal, 179 West Washington Street. Meets at noon on the second and fourth Wednesday of each month at 424 South Wabash Ave.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, Ernest S. Cowie, 1613 Grand Ave., Kansas City, Mo.

ELECTRICAL CONTRACTORS' ASSOCIATION OF WISCONSIN. Secretary, Albert Peterman, 626 Lloyd St., Milwaukee, Wis.

ELECTRICAL CREDIT ASSOCIATION OF CHICAGO. Secretary, Frederick P. Vose, 1343 Marquette Building, Chicago. Annual meeting, Chicago, November.

ELECTRICAL CREDIT ASSOCIATION OF PHILADELPHIA. Secretary, John W. Crum, 1324 Land Title Building, Philadelphia, Pa.

ELECTRICAL SALESMEN'S ASSOCIATION. Secretary, Francis Raymond, 125 Michigan Ave., Chicago, Ill.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill. Next meeting, Hot Springs, Va., Nov. 18-20.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, Harding Building, 34 Ellis St., San Francisco, Cal. Meeting, San Francisco, second Thursday of each month.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Secretary, Harvey Robinson, 124 West 42d Street, New York.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA, NEW ENGLAND SECTION. Secretary, L. L. Edgar, 39 Boylston St., Boston.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 29 West 39th St., New York.

FARADAY ELECTRICAL ASSOCIATION. Secretary, W. J. Collins, 1129 Masonic Temple, Chicago. Meets at noon on the first and third Wednesday of each month at Planters' Hotel.

GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION OF OKLAHOMA. Secretary-treasurer, Prof. H. V. Bozell, Norman, Okla. Annual meeting, May, 1914.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary, H. E. Chubbuck, Peoria, Ill.

ILLUMINATING ENGINEERING SOCIETY. General secretary, J. D. Israel, Engineering Societies Building, 29 West 39th St., New York. Sections in New York, New England, Philadelphia, Chicago and Pittsburgh.

INDEPENDENT ELECTRICAL CONTRACTORS' ASSOCIATION OF GREATER NEW YORK. Secretary, A. Newburger, 1153 Myrtle Ave., Brooklyn, N. Y.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donahue, Lafayette, Ind.

INSTITUTE OF OPERATING ENGINEERS. Secretary, L. Houmiller, 29 West 39th St., New York.

INSTITUTE OF RADIO ENGINEERS. Secretary, E. J. Simon, 81 New St., New York. Annual meeting, New York, January, 1914.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex.

INTERNAL-COMBUSTION ENGINEERS' ASSOCIATION. President, Charles Kratsch, 416 West Indiana St., Chicago. Meeting second Friday of each month at Lewis Institute.

INTERNATIONAL ELECTRICAL CONGRESS. Secretary, Dr. E. B. Rosa, Bureau of Standards, Washington, D. C. San Francisco, Sept. 13-18, 1915.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England. Meeting at San Francisco, Sept. 6-11, 1915.

IOWA ELECTRICAL ASSOCIATION. Affiliated with N. E. L. A. Secretary, H. B. Maynard, Waterloo, Ia.

IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, H. E. Weeks, Davenport, Ia. Annual meeting, Cedar Rapids, April 23, 1914.

JOVIAN ORDER. Jupiter (president), W. N. Matthews, St. Louis, Mo.; Mercury (secretary), E. C. Bennett, Syndicate Trust Building, St. Louis, Mo.

KANSAS GAS, WATER, ELECTRIC LIGHT AND STREET RAILWAY ASSOCIATION. Secretary-treasurer, Ivor Thomas, 237 South Main St., Wichita, Kan.

LOUISIANA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, W. H. Bower Spangenberg, 625 Poydras St., New Orleans, La.

MAINE ELECTRIC ASSOCIATION. Secretary-treasurer, Walter S. Wyman, Waterville, Maine.

MINNESOTA ELECTRIC ASSOCIATION. Secretary-treasurer, F. A. Otto, St. Paul Gas Light Company, St. Paul, Minn. Annual meeting, Minneapolis, March, 1914.

MISSISSIPPI ELECTRIC ASSOCIATION (affiliated with the National Electric Light Association). Secretary-treasurer, Frank J. Duffy, Natchez, Miss.

MISSOURI ELECTRIC, GAS, STREET RAILWAY AND WATER WORKS ASSOCIATION. Secretary-treasurer, F. D. Beardslee, Union Electric Light & Power Co., St. Louis. Annual meeting, May, 1914.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, Wm. L. Smith, Concord, Mass.

NATIONAL DISTRICT HEATING ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, Engineering Societies Building, 33 West 39th St., New York. Annual meeting, Philadelphia, May, 1914.

NATIONAL ELECTRIC LIGHT ASSOCIATION, COMMERCIAL SECTION. Secretary, J. F. Becker, 1170 Broadway, N. Y.

NATIONAL ELECTRIC LIGHT ASSOCIATION, EASTERN NEW YORK SECTION. Secretary, C. S. Van Dyck, Schenectady, N. Y.

NATIONAL ELECTRIC LIGHT ASSOCIATION, HYDROELECTRIC SECTION. Secretary, S. A. Sewall, 29 West 39th St., New York.

NATIONAL ELECTRIC LIGHT ASSOCIATION, MICHIGAN SECTION. Secretary, Herbert Silvester, 18 Washington Boulevard, Detroit, Mich.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NEBRASKA SECTION. Secretary-treasurer, S. J. Bell, David City, Neb.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NEW ENGLAND SECTION. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NORTHWEST SECTION. Secretary, N. W. Brockett, Pioneer Building, Seattle, Wash.

NATIONAL ELECTRIC LIGHT ASSOCIATION, SOUTHEASTERN SECTION. Secretary-treasurer, A. A. Wilbur, Columbus, Ga.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, George H. Duffield, 41 Martin Building, Utica, N. Y.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1343 Marquette Building, Chicago. Annual meeting, June, 1914.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee, Ralph Sweetland, 141 Milk Street, Boston, Mass. Open meeting, New York, March, 1915.

NATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary-treasurer, Richard Valentine, Janesville, Wis.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 60 State St., Boston, Mass. Directors meet first Wednesday of each month.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, H. A. Faulkner, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

NEW ORLEANS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, S. J. Stewart, 312 Carondelet St., New Orleans, La. Meetings, second and fourth Tuesday of each month.

NEW YORK ELECTRIC RAILWAY ASSOCIATION. Secretary, Charles C. Dietz, 598 Broadway, Albany, N. Y.

NEW YORK ELECTRICAL CREDIT ASSOCIATION (affiliated with the National Electrical Credit Association). Secretary, Franz Neilson, 80 Wall St., New York. Annual meeting, Dec. 9.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, 33 West 39th St., New York. Annual meeting, New York, June, 1914.

NORTHWESTERN CEDARMEN'S ASSOCIATION. Secretary, N. E. Boucher, 743 Lumber Exchange, Minneapolis, Minn. Annual meeting, Jan. 6, 1914.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus, Ohio. Annual meeting, Columbus, Ohio, Nov. 20-22.

OREGON ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, F. C. Green, 291 East Morrison St., Portland, Ore. Annual meeting, April, 1914.

PENNSYLVANIA ELECTRIC ASSOCIATION (State Section N. E. L. A.). Secretary-treasurer, S. C. Pohe, Bloomsburg, Pa.

RAILWAY SIGNAL ASSOCIATION. Secretary-treasurer, C. E. Rosenberg, Times Bldg., Bethlehem, Pa.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. General manager, J. M. Wakeman, 29 West 39th St., New York.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Prof. H. H. Norris, Ithaca, N. Y. Annual meeting, Princeton, N. J., June, 1914.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Texas.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, A. B. Marsden, Manchester, Vt.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 76 West Monroe St., Chicago, Ill. Annual meeting, Cincinnati, Jan. 27-29.

WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, George Allison, Stephenson Building, Milwaukee, Wis. Annual meeting, Jan. 15 and 16, 1914.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED OCT. 21, 1913.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,076,020. AUTOMATIC SWITCH FOR TELEPHONE EXCHANGE SYSTEMS; E. E. Clement, Washington, D. C. App. filed May 17, 1910. Selective switch, including bank contacts arranged in rows, and wiper contacts on a spindle which is rotated by an electromagnet.

1,076,026. LAMP SOCKET; J. Darby and C. D. Meeker, Orange, N. J. App. filed Feb. 4, 1910. Double-break pull socket.

1,076,027. STORAGE-BATTERY GRID; J. N. Davis, Denver, Col. App. filed March 17, 1913. Body portion which receives active material is made of greater thickness than the frame part.

1,076,032. ELECTRICAL CONNECTION; P. E. Gilling, East Orange, N. J. App. filed July 29, 1910. Friction slip connection for spark plugs.

1,076,041. TELEPHONE TRANSMITTER; W. Kaisling, Chicago, Ill. App. filed March 15, 1906. Interposes damping springs between the main diaphragm and the granule chamber.

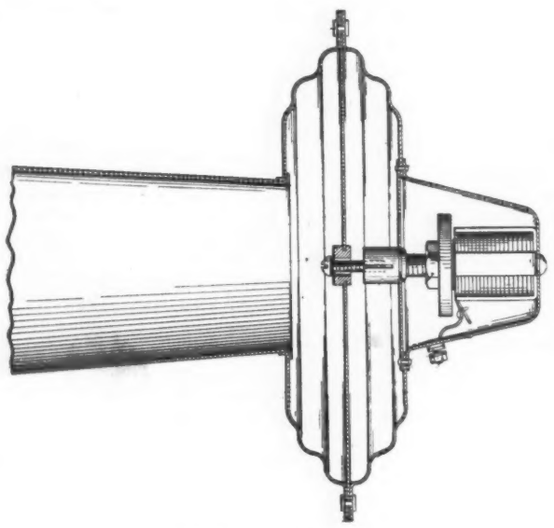
1,076,054. ELECTRODE HOLDER; J. Orr, Schenectady, N. Y. App. filed April 19, 1911. Contact plates linked together and clamped in snug engagement with electrode.

1,076,058. ELECTRIC VAPOR APPARATUS; E. Podszus, Rixdorf, Berlin, Germany. App. filed Oct. 4, 1909. Lamp in which the vapor is forced to traverse the envelope in a narrow jet.

1,076,091. FLASHLIGHT PHOTOGRAPHIC APPARATUS; C. D. Allen, New York, N. Y. App. filed June 3, 1912. Squeezing of bulb opens the shutter and simultaneously closes circuit to set off powder.

1,076,141. PREPARATION OF RADIOTHORIUM; L. Meitner, Berlin, Germany. App. filed Feb. 18, 1913. Electrolyzes solutions containing radiothorium in large excess and no, or very little, thorium, and precipitates the radiothorium at the cathode.

1,076,149. AUTOMATIC ELECTROMAGNETIC SWITCH; J. N. Reynolds, Greenwich, Conn., and A. F. Dixon, Newark, N. J. App. filed Oct. 5, 1910. Has rotatable shaft carrying a series of disks on which segmental contacts are insulatively secured and stationary spring contacts engaged by the segmental contacts.



1,076,181.—Electric Horn.

1,076,157. AUTOMATIC HEAT ALARM; J. G. Schlüchtner, Brooklyn, N. Y. App. filed April 25, 1912. Mercury receptacle consists of communicating superposed flattened chambers; concentric electrodes dip into the receptacle to different levels.

1,076,176. RAILWAY SIGNALING SYSTEM; A. L. Vencill, Wilkinsburg, Pa. App. filed Jan. 29, 1912. Automatic signals for single-track road.

1,076,181. ELECTRIC HORN; G. M. Willis, Chicago, Ill. App. filed June 20, 1913. Alternating-current horn; armature is mounted on spring diaphragm and carries a screw, the head of which impinges upon and vibrates the sounding diaphragm.

1,076,207. CONTROL SYSTEM; C. C. Heinzmann, Indianapolis, Ind. App. filed Oct. 11, 1912. Damper-regulating system; prevents damper being left open because of weakening of electrical energy source.

1,076,210. CATAPHORIC ELECTRODE; D. E. Kerr and H. Wilson, Conneaut, Ohio. App. filed Feb. 26, 1913. The electrode is mounted within the medicine container.

1,076,212. PROTECTING MERCURY-VAPOR APPARATUS; O. O. Kruh, Schenectady, N. Y. App. filed Sept. 20, 1907. Prevents cathode spot from shifting to the anode by equalizing the static stress between the cathode and anode.

1,076,213. ELECTROMAGNETIC SEPARATOR; E. Langguth, Neerpelt, Belgium. App. filed April 26, 1912. Comprises a stationary induction body, the separating surface of which represents a closed ring relatively to which a multipolar system of magnets is rotatable.

1,076,214. ELECTRIC RAILWAY AND ELECTRIC MOTOR CONTROL; H. W. Leonard, Bronxville, N. Y. App. filed March 25, 1908. For operating certain sections of the system at low tension (as in a city) and other sections at high tension (as in the country).

1,076,217. COMMUTATOR TRUING DEVICE; F. G. Ludwig, Lockport, Ill. App. filed May 31, 1913. Resiliently supported abrasive holder which may be locked in inoperative position.

1,076,236. SUPPORT FOR ELECTRICAL TAPS OR OUTLETS; J. Sachs, Hartford, Conn. App. filed June 16, 1911. Magnetic base carrying lamp sockets or other outlets.

1,076,271. WELDING MACHINE; T. E. Crecelius, St. Louis, Mo. App. filed April 24, 1912. For welding sections of tubing.

1,076,278. SELECTIVE CALLING KEY; M. F. Geer and R. C. Leake, Rochester, N. Y. App. filed Dec. 22, 1910. Includes a normally inactive converter and manually operable means for starting the same.

1,076,292. ELECTRODE LEAD; C. A. Kraus, Newton Highlands, Mass., and R. D. Mailey, Lynn, Mass. App. filed June 30, 1910. For vapor electric apparatus; tube of highly conductive material sheathed within and without with metal resistant to the action of mercury.

1,076,298. ELECTRIC BRAKE; J. N. Mahoney, Wilkinsburg, Pa. App. filed April 20, 1908. Of the type wherein the brake-applying current is supplied from the car motors connected up to act as generators in a local brake circuit.

1,076,303. SELECTIVE SIGNALING SYSTEM; J. McFell, Chicago, Ill. App. filed April 19, 1910. Selector devices operate annunciators by transmission over the line wire of groups of signal impulses constituting a plural-digit number signal appropriate to an individual station.

1,076,304. FIRE-ALARM AND WATCH-SERVICE SIGNALING MEANS; J. McFell, Chicago, Ill. App. filed May 8, 1911. Has main and emergency signaling circuits.

1,076,387. DISCONNECTING SWITCH; A. J. Pahl, San Francisco, Cal. App. filed Aug. 13, 1912. Automatically disconnects the broken portion of a high-tension feed line and at the same time grounds the same.

1,076,394. THERMAL CIRCUIT CLOSER; J. F. Scheuer, Two Rivers, Wis. App. filed May 5, 1913. Spring contact soldered to cover to hold it normal on open circuit.

1,076,395. ELEVATOR SIGNAL SYSTEM; N. L. Schloss, New York, N. Y. App. filed Aug. 28, 1912. Signal given on any floor indicates simultaneously in each car of the system from which floor the signal has been given.

1,076,407. LOCOMOTIVE; H. G. Chatain, Erie, Pa. App. filed May 13, 1912. Internal-combustion engine in two principal parts, between which parts is situated the field-magnet frame of the generator which supplies current to the motors whose rotors are mounted on the locomotive axles.

1,076,424. PROCESS OF TREATING LARGE FERMENTATION VESSELS; H. Held, Nuremberg, Germany. App. filed Oct. 22, 1909. Vessel containing copper electrolyte rotated as a cathode, and thereafter a silver coating is produced in like manner.

1,076,438. THERMO-ELECTRIC ELEMENT; A. L. Marsh, Detroit, Mich. App. filed Sept. 30, 1912. Nickel and silicon with an added quantity of manganese as an auxiliary to remove shortness.

1,076,445. ELECTROCAPILLARY CONTRIVANCE; A. Orling, London, Eng. App. filed Oct. 6, 1911. Has converging capillary tubes.

1,076,448. FREQUENCY INDICATOR; W. H. Pratt, West Lynn, Mass. App. filed Sept. 19, 1911. One of the two relatively movable elements of the instrument is provided with two windings exerting opposing forces on the other element, the circuits of the two windings being tuned to frequencies above and below the average frequency.

1,076,467. METHOD OF WELDING; E. Thomson, Swampscott, Mass. App. filed March 14, 1910. Heats engaging parts of a wheel rim and a wheel center to plasticity and then forces them laterally together into a common plane.

1,076,477. CLUSTER LAMP SOCKET; C. H. Bissell, Syracuse, N. Y. App. filed March 18, 1912. Has terminals by which either a pendent switch or an additional lamp may be connected to the cluster.

1,076,481. ELECTROMAGNETIC DEVICE; S. C. Bryant, Chicago, Ill. App. filed May 29, 1912. For operating a bell of the "locomotive type."

1,076,485. STORAGE BATTERY; W. A. Crowdus, Chicago, Ill. App. filed July 16, 1913. Battery couple consists of sheets of flexible metal separated by fibrous insulating material and provided at intervals with interstitial tubes filled with active material.

1,076,497. PROCESS FOR SEPARATING PHOSPHORIC ACID FROM NATURAL PHOSPHATES; M. M. Haff, Ottawa, Ontario, Canada. App. filed April 4, 1912. Subjects natural phosphate with a non-feldspathic aluminum silicate to the heat of the electric arc.

1,076,499. PROCESS FOR SEPARATING PHOSPHORIC ACID FROM NATURAL PHOSPHATE; M. M. Haff and T. L. Willson, Ottawa, Ontario, Canada. App. filed Oct. 19, 1912. Subjects natural phosphate with silicious material to electric heat and recovers volatilized phosphoric acid.

1,076,518. ELECTRIC FURNACE; I. Rennerfelt, Halmstad, Sweden. App. filed Feb. 26, 1912. Rotatable crucible with end electrodes mounted on adjustable shields.

1,076,530. ELECTRIC FIREARM; A. Tepins, Paris, France. App. filed Jan. 5, 1911. Circuit for firing can be completed only when gun has been carried to the shoulder.

1,076,607. THERMAL CIRCUIT CLOSER; J. F. Scheuer, Two Rivers, Wis. App. filed Feb. 8, 1913. Exposed fusible block holds spring contact normally away from other contact.

1,076,614. WINDING APPARATUS; J. G. P. Thomas, Holywell Vicarage, Wales. App. filed June 29, 1912. For crane work, rolling mills and the like; by balanced gearing electrical power is stored through operation of an electrical machine during periods of rest or light load, which power is returned at times of heavy load.

1,076,630. SUPPORTING STRUCTURE FOR TROLLEY CONDUCTORS; H. P. Davis and T. Varney, Pittsburgh, Pa. App. filed Oct. 19, 1904. For high-tension alternating-current service; U-shaped guard wires or rods encircle the messenger wire which supports the trolley wire.

1,076,631. RAILWAY TRAFFIC-CONTROLLING SYSTEM; F. L. Dodgson, Rochester, N. Y. App. filed March 27, 1903. Semaphore system.